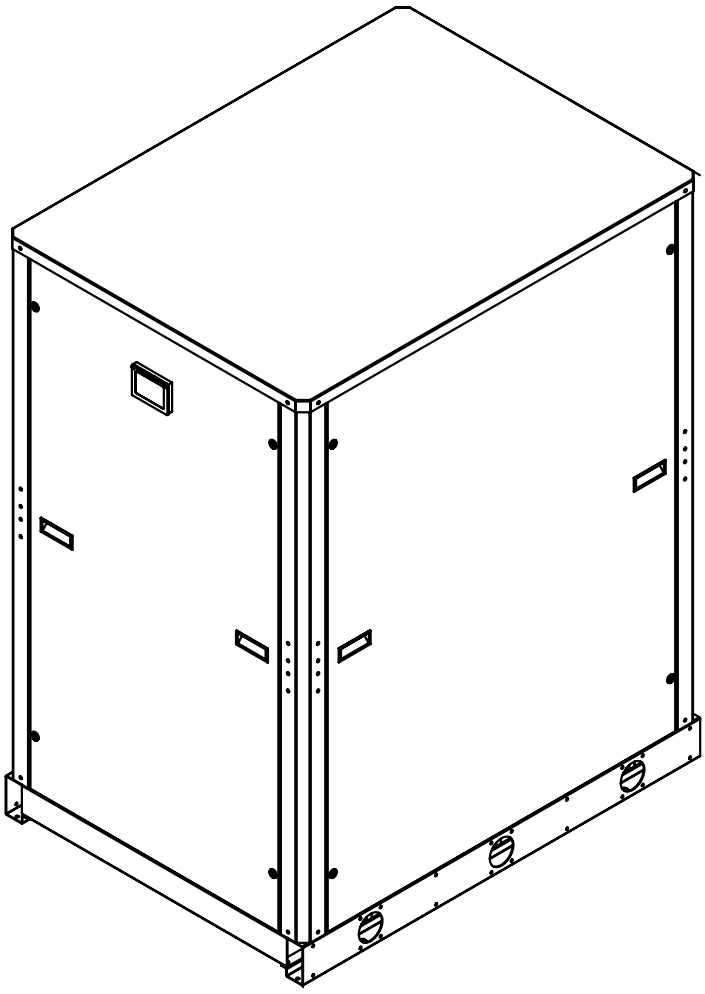
Ferroli

EGW

CONDENSERLESS WATER CHILLERS

61 ÷ 40 kW in cooling mode

ECO-FRIENDLY R410A REFRIGERANT GAS



CE

INSTALLATION MANUAL

Dear Customer,
Thank you for having purchased a FERROLI Idustrial coolers. It is the result of many years experience, particular research and has been made with top quality materials and higlly advanced technologies.The CE mark guaranteed thats the appliances meets European Machine Directive requirements regarding safety.
The qualitative level is kept under constant surveillance. FERROLI products therefore offer SAFETY, QUALITY and RELIABILITY.
Due to the continuous improvements in technologies and materials, the product specification as well as performances are subject to variations without prior notice.

Thank you once again for your preference.
FERROLI S.p.A

CE

GB **"CE" DECLARATION OF CONFORMITY**
We, the undersigned, hereby declare under our responsibility, that the machine in question complies with the provisions established by Directives :

DE **"EG" KONFORMITÄTSERKLÄRUNG**
Wir, die Unterzeichner dies er Erklärung, erklären unter unseren ausschlie ßlichen Verantworfung, daß die genannte Maschine den Bestimmungen der folgenden EG-Richtlinien entspricht :

FR **DECLARATION "CE" DE CONFORMITE**
Nous soussignés déclarons, sous notre entière responsabilité, que la machine en objet est conforme aux prescriptions des Directives :

IT **DICHIARAZIONE "CE" DI CONFORMITÀ**
Noi sottoscritti dichiariamo, sotto la nostra responsabilità, che la macchina in questione è conforme alle prescrizioni delle Direttive :

ES **DECLARACION "CE" DE CONFORMIDAD**
Quienes subscribimos la presente declaracion, declaramos, baio nuestra exclusiva responsabilidad, que la maquina en objeto respeta lo prescrito par las Directivas :

PT **DECLARAÇÃO "CE" DE CONFORMIDADE**
Nós, signatários da presente, declaramos sob a nassa exclusiva responsabilidade, que a má quina em questão está em conformidade com as prescrições das Directrizes :

NL **"EG" CONFORMITEITSVERKLARING**
Wij ondergetekenden verklaren hierbij op uitsluitend eigen verantwoording dat de bovengenoemde machine conform de voorschriften is van de Richtlijnen:

DK **"CE" OVERENSSTEMMELSESERKLERING**
Underfegnede forsikrer under eget ansvar al den ovennævnte maskine er i overensstemmelse med vilkårene i direktiveme :

SE **FÖRSÄKRAN OM "CE" ÖVERENSSTÄMMELSE**
Underfecknade försäkrar under eget ansvar alt ovannämnda maskinskinen er i overensstemmelse med vilkarene i direktivene :

NO **BEKREFTELSE OM ÆCEØ OVERENSSTEMMELSE**
Underfegnede forsikrer under eget ansvar al den ovennevnte maskinen er i overensstemmelse med vilkarene i direktivene :

FI **"CE" VAATIMUSTENMUKAISUUSVAKUUTUS**
Allekirjoittaneet vakuutamme omalla vastuullamme että yllämainittu kone noudattaa ehtoja direktiiveissä :

GR **ΔΗΛΩΣΗ ΣΥΜΒΑΤΟΤΗΤΑΣ "ΕΕ"**
Εμετς που υπογραφουμε την παρουσα, δηλωνουμε υπο την αποκλειστικη μας ευθυνη, οτι το μηχανημα συμμορφουται οτα οσ α ορτζουν οι Οδηγιες :

HR **IZJAVA O "CE" SUGLASNOSTI**
Mi niže potpisani izjavljujemo, pod našom odgovornošu, da ova Mašina odgovara zahtijevima iz Direktiva :

PL **DEKLARACJA ZGODNOŚCI "CE"**
My niżej podpisani oświadczamy z pełną odpowiedzialnością, że niżej wymienione urządzenie w pełni odpowiada postanowieniom przyjętym w następujących Dyrektywach:

2006/42/EC
97/23/EC
2004/108/EC
2006/95/EC

TABLE OF CONTENTS

THIS MANUAL IS DIVIDED INTO SECTIONS. THEIR NAMES APPEAR IN THE HEADING OF EACH PAGE.

GENERAL SPECIFICATIONS

General specifications

• This manual and the wiring diagram supplied with the unit must be kept in a dry place and ready to hand for future consultation when required.
• This manual has been compiled to ensure that the unit is installed in the correct way and to supply comprehensive information about how to correctly use and service the appliance. **Before proceeding with the installation phase, please carefully read all the information in this manual, which describes the procedures required to correctly install and use the unit.**
• Strictly comply with the instructions in this manual and conform to the current safety standards.
• The appliance must be installed in accordance with the laws in force in the country in which the unit is installed.
• Unauthorized tampering with the electrical and mechanical equipment will **VOID THE WARRANTY.**
• Check the electrical specifications on the identification plate before making the electrical connections. Read the instructions in the specific section where the electrical connections are described.
• If the unit must be repaired for any reason, this must only be done by a specialized assistance center recognized by the manufacturer and using geuine spare parts.
• The manufacturer also declines all liability for any damage to persons or property deriving from failure of the information in this manual to correspond to the actual machine in your possession.
• Proper uses: this series of chillers is designed to produce cold or hot water for use in hydronic systems for conditioning/ heating purposes. The units are not suitable for the production of domestic hot water.
Any use differing from this proper use or beyond the operating limits indicated in this manual is forbidden unless previously agreed with the manufacturer.
• The prevention of the risk of fire at the installation site is the responsiblity of the end user.

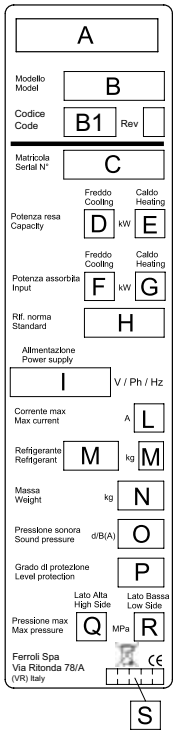
European Directives

The company hereby declares that the machine in question complies with the matters prescribed by the following Directives:

•	Machine Directive	**2006/42/CE**
•	Directive governing pressurized vessels (PED)	**97/23/CE**
•	Electromagnetic compatibility Directive (EMC)	**2004/108/CE**
•	Low voltage Directive (LVD)	**2006/95/CE**

Any other Directives have to be considered not applicable.

Identification plate of the Unit



The figure on the left depicts the identification plate of the unit, affixed to the outer left-hand side of the Electric Panel.
A description of the data is given below:

Standard versions

A - Trademark
B - Model
B1- Code
C - Serial number
D - Cooling Capacity
E - Heating Capacity
F - Power input in COOLING mode
G - Power input in HEATING mode
H - Reference standard
I - Electric power supply
L - Maximum load current
M - Type of refrigerant and charge
N - Shipping weight of the unit
O - Sound pressure level at 1m
P - IP Level Protection
Q - Maximum pressure - High Side
R - Maximum pressure - Low Side
S - PED certification authority

GENERAL SPECIFICATIONS

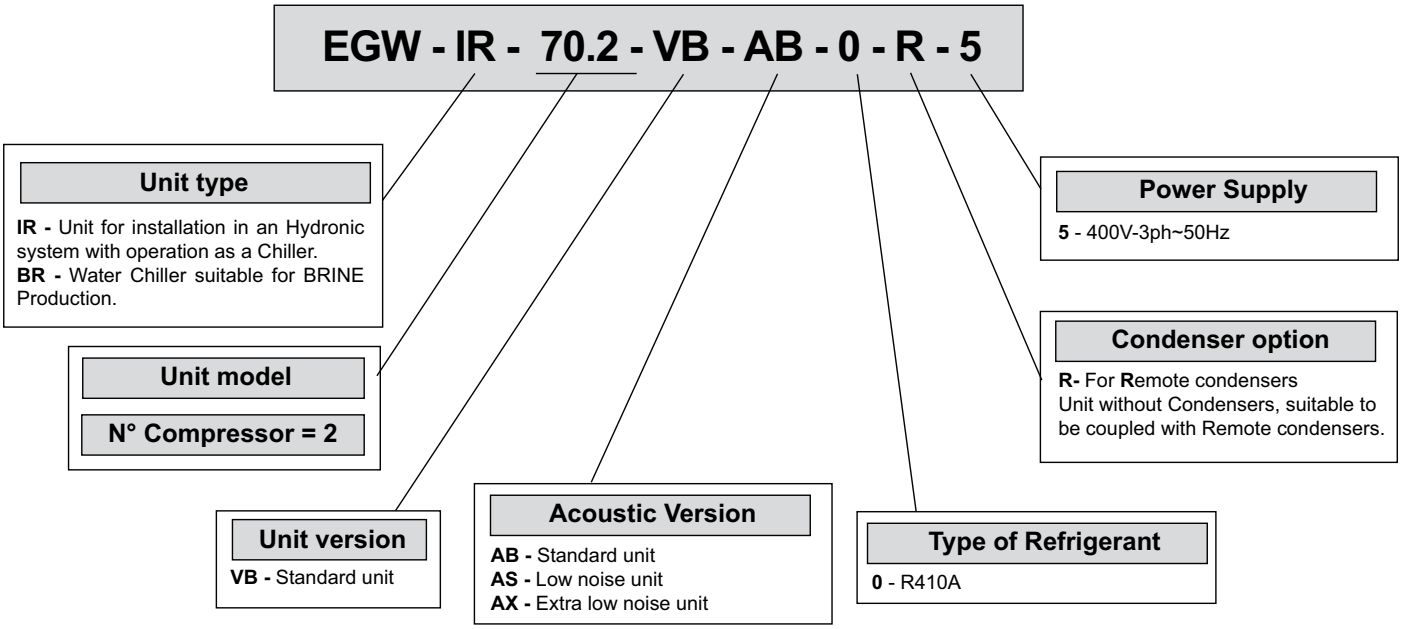
Presentation of the unit

This new series of industrial condenserless units has been designed to meet the demands of global markets in the small medium power industrial and commercial plants.
Units are compact and highly configurable, built to fit different types of plants so to meet the
needs of highly qualified engineers. Units are only cooling (IR) suitable for indoor installation; and, if equipped with painted structure and panels (option), they are suitable for outdoor installation too. This series is composed of 11 models and two sizes with nominal cooling capacity from 61 to 210 Kw. The units produce cold water from 5 to 20°C.
The units can be supplied for brine production (BR) that allow brine production from -10 to 5°C.
To increase the seasonal efficiency index (ESEER) and so further containing power input and operation cost the units can be supplied with electronic expansion valve. Great attention has been dedicated to achieve low sound levels in order to meet the increasingly restrictive laws in terms of noise: upon request, you can choose for a Standard Unit (AB) or Low noise unit (AS) or Extra low noise unit (AX), The low noise unit (AS) provides sound attenuation thanks to panels with sound absorbing insulation. The extra low noise unit (AX) provides a further sound attenuation thanks to panels with sound absorbing and acoustic jackets for compressors. The basic unit (AB) is an essential structure made by sheet metal with anti-corrosion treatment (not painted) and without any closing panels so suitable ONLY for indoor installation.
All the units are equipped with 2 scroll compressors arranged in pairs (tandem) on 1 circuit operating with environmental friendly R410A gas, brazed plate heat exchangers on plant side (evaporator) completely insulated and protected on water side with a differential pressure control), electrical panel complete with electronic controller and display, phase presence and sequence control device (as standard).
As option the unit can be selected with painted structure (epoxy powders RAL 7035).
For low noise (AS) and extra low noise (AX) units, the painting is extended to all closing panels, so ensuring for the electrical panel a protection degree IP54 and the maximun protection against adverse weather conditions: with this features the unit is suitable for outdoor installation (to agree with our commercial office).
The units are supplied charge with NITROGEN (in order to avoid entrance of air into the refrigerant circuit).
A variety of other accessories are available to extend the capabilities of the units.
All units are accurately build in compliance with the existing standards and are individually tested in factory.

GENERAL SPECIFICATIONS

Identification code of the unit

The codes that identify the units are listed below and include the sequences of letters that determine the meanings for the various versions and set-ups.



The available special versions are described below:

AB Standard unit. The compressors are installed on rubber vibration dampers.
The unit has composed by basement and framework made by sheet metal with anticorrosion treatment without any closing panels.

AS Low noise unit. Allows a noise reduction of 4-5 dB.
The compressors are installed on rubber vibration dampers and the unit is closed with panels made by sheet metal with anticorrosion treatment and coated with sound absorbing insulation.
The AS unit reaches IP54 (protection degree) so it can be installed outdoor.

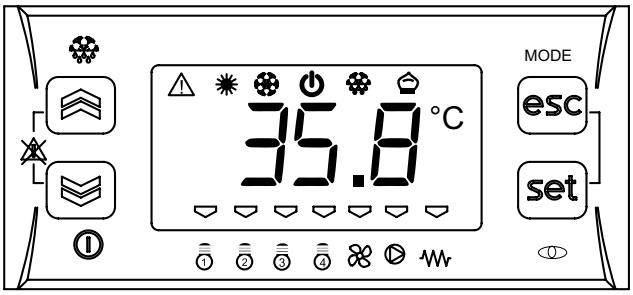
AX Extra low noise unit. Allows a noise reduction of 7-8 dB.
The compressors are installed on rubber vibration dampers and insulated with acoustic jackets; the unit is closed with panels made by sheet metal with anticorrosion treatment and coated with sound absorbing insulation.
The AX unit reaches IP54 (protection degree) so it can be installed outdoor.

Description of the components

Componenti principali:
1. Electric control and monitoring panel. This is housed in a metal casing in which the various electrical components are positioned on one metal plate.
1a. The power section includes:
• Main door-locking circuit-breaker.
• Fuse-holder that can be isolated with protection fuse triad for each compressor.
• Fuse-holder that can be isolated with protection fuse for compressor oil heaters and antifreeze (if installed).
• Control contactor for each compressor.
• Contactor and magnetothermic switch to protect the pump (if installed).
• Phase presence and sequence monitoring device on power supply
1b. The auxiliary section includes:
• Fuses on the auxiliary transformer.
• Electromagnetic noise filter
• Insulating and safety transformer to power the auxiliary circuit.

GENERAL SPECIFICATIONS

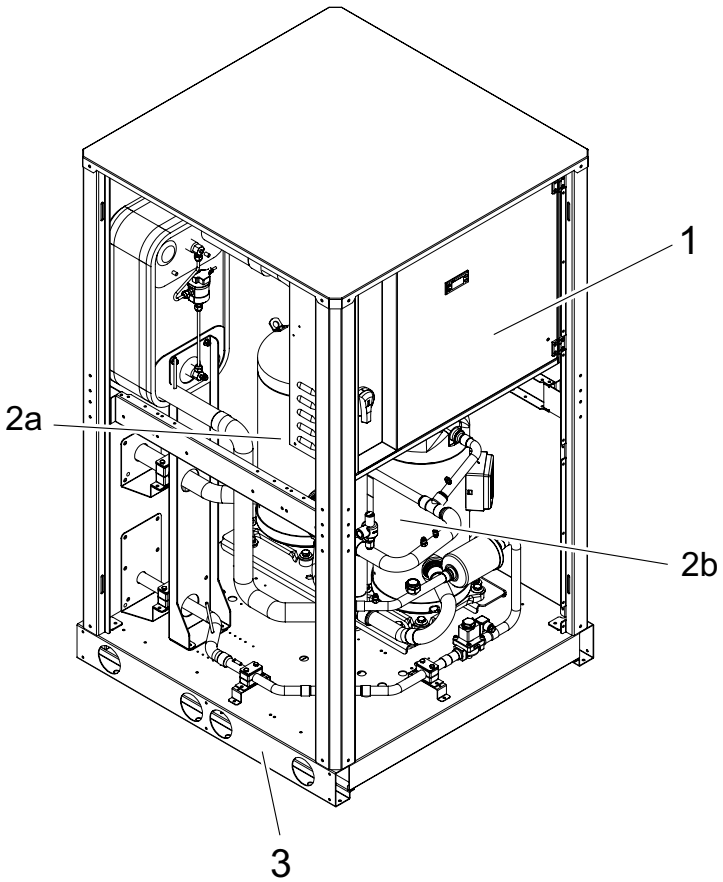
1c. The microprocessor monitoring section includes:
- User interfacing terminal with display.
- On-off key.
- Operating mode selector key.
- Compressor on-off display **LED**.
- Operational mode **LED**
- Antifreeze heaters activated indicator **LED**.
- Source Pump/s on-off display **LED**
- Plant Pumps on-off display **LED**
- Check-control with fault code display
- ON / Stand-by remote - Summer/Winter (E/I) remote selection (IW, IP. BW, BP units only).



Control system main functions:
temperature control of the water produced by the unit, compressor and pump operating hour counter, timing and cycling of start-ups, input parameters by keyboard, alarms management, operating mode change (IW, IP. BW, BP units only), dynamic set-point (climatic control), scheduling and integrative heaters control.
If installed the hydronic kit these functions are enabled: antifreeze with pump, start-up cycle after prolonged inactivity (antisticking), if the hydronic kit installed has 2 pumps there is a cycling between each pump to ensure an equivalent lifetime,
Digital input functions: low pressure, high pressure, high temperature on compressor supply, phase presence and sequence monitoring device on power supply, differential water pressure control, compressors thermal protection, pumps thermal protection, ON / Stand-by remote and remote operating mode change, demand limit and Economy function,
Digital output functions: compressor start-up, pump start-up, plate heat exchanger electrical heater,
remote general alarm, 4-way valve (only IP,BP unit), integrative heaters.
Analogic input functions: in and out water temperature for palnt and source sides, external air temperature probe (if present).
Analogic output functions: continuous control (0-10V) for 2 or 3 way valves (supplied as accessory too) or for inverter pumps for condensing control.

2. Compressors. They are the **SCROLL** type with orbiting coil equipped with built-in thermal protection. The AX unit includes: an acoustic jacket for the compressors. All units are equipped with two compressors connected in pairs (1 single refrigerant circuit) which can operate at the same time (**100% cooling capacity**) or individually (**50% of the cooling capacity**), thus adapting to the different thermal loads of the system.

3. Frame structure made of sheet metal with anticorrosion treatment and– as option- coated with epoxy powders (RAL 7035 to ensure maximun protection against adverse weather conditions.



The image refer to IR unit Mod. 90.2

GENERAL SPECIFICATIONS

4. Plant Exchanger made of brazed stainless steel plates (**AISI 316**). It is installed in a shell of heat-insulating material to prevent the formation of condensation and heat exchanges towards the outside. Standard supply also includes a differential pressure switch on the water circuit to avoid the risk of freezing if the water flow is shut off for some reason.
It can be equipped with antifreeze heater.

Covering panels (for AS and AX units, or as accessory for AB unit**)**, made of galvanized sheet metal, if painting option (VER) is selected the panels are provided coated with epoxidic powder paint (RAL 7035) to ensure maximun protection against adverse weather conditions.

5. Dehydrator filter. Mechanical type. Retains impurities and traces of moisture in the circuit. **Hermetic** type for models **70÷90**; **cartridge** type for models **105÷240**.

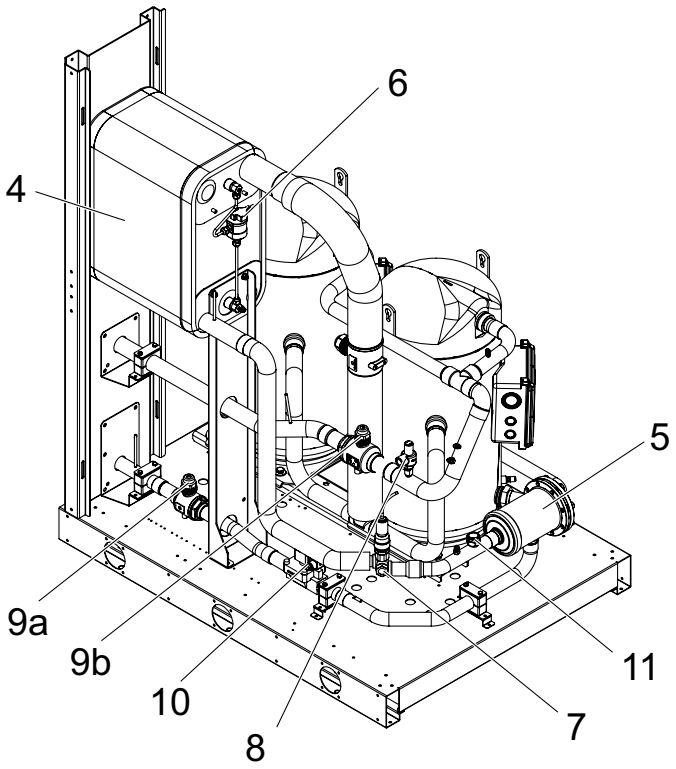
6. Water differential pressure switch. It is installed on the connections between the water inlet and outlet of the exchanger. It stops the unit if it activates.

7. Thermostatic expansion valve. With external equalizer, this feeds the evaporator correctly, keeping the selected superheat degree at a steady level.
Electronic Expansion valve (optional), feeds the evaporator correctly, keeping the selected superheat degree at a steady level; it guarantees an effective and quick response to the load modifications so increasing the efficiency at partial load.

8. Refrigerant Safety valve. Installed on the discharge pipe of the compressors, this operates if extreme faults should occur in the system.

9a. - 9b. Gas and Liquid shut-off valves. Allow that all the refrigerant can be pumped in the coil (remote condenser when it is connected to the condenserless unit) and then stored in order to carry out servicing work or to replace all the components of the refrigerant circuit without having to drain it.

10. liquid Solenoid Valve. It shuts off when both the compressors of the circuit switch off, preventing liquid refrigerantfrom flowing towards the evaporator during periods at a standstill.



The image refer to IR unit Mod. 90.2

11. Liquid and moisture indicator. Signals if refrigerant is in liquid state so indicating that the refrigerant charge is correct.
The indicator light also indicates the amount of moisture in the refrigerant by changing colour.

Low pressure switch. With fixed setting. It is installed on the suction pipe and blocks the compressors if the operating pressures drop below the tolerated values. Automatically resets as the pressure increases. If it activates frequently, the unit will block and can only be restarted by resetting via the user interface terminal.

High pressure switch (n°2). With fixed setting. Are installed on the discharge pipe and blocks the compressors if the operating pressure exceeds the tolerated values. If it activates, the unit will block and can only be restarted by resetting via the user interface terminal.

Pressure taps: 5/16 " SAE. Allow the operating pressure of the system to be measured:compressor discharge, expansion valve inlet, compressor suction.

Pressure taps: 1/4 " SAE (7/16" UNF) type with schraeder pin. Allow the charge/discharge of the refrigerant gas from the system.

ACCESSORIES AND OPTIONAL EQUIPMENT

RC (F) Remote Condensers. It is possible to supply several types of air cooled remote condensers following different project specification as for instance different noise levels (standard, low noise, eXtra low noise), coils with coated or copper fins, ecc. The remote condensers can be equipped with specific accessories as for instance sheet metal support for horizontal installation, electrical wiring box, electrical panel (CE marked), fans speed control by cut of phase for head pressure control.

Specifical accessories for condenserless units

PAN - Covering panels (M) (accessory only for AB unit), made of galvanized sheet metal, if painting option (VER) is selected the panels are provided coated with epoxidic powder paint (RAL 7035) to ensure maximun protection against adverse weather conditions.

AVG - Rubber vibration dampers (F). Consisting of 4 rubber vibration dampers to fit under the unit. Reduce the transmission of the mechanical vibrations generated by the compressors and pumps during normal operation to the basement of the unit. The insulating degree of the vibration dampers is about 85-90%.

GM - Pressure gauge unit (M). Consisting of 2 pressure gauges that display the pressure values of the refrigerant on the suction and discharge of the compressors.

AV – Victaulic Connections (F) Consisting of 2 Victaulic-brackets and 2 pipe Victaulic-Welding.

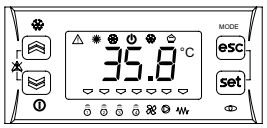
CV – Victaulic Elbows (F) Consisting of 2 brackets and 2 elbows Victaulic-Victaulic.

VA – Water valves (F) Consisting of 2 brackets and 2 water valves Victaulic to shut-off the unit from the plant or from the source.

F – Victaulic Water Filter Y (F). Consisting of 1 bracket and 1 Victaulic water filter of "Y" shape. Can be turned on and off and inspected. It prevents that machining residues (dust, swarf, etc.) in the water pipes can enter into the plate-type heat exchanger.

FLS - Flow switch (F). Paddle flow switch on the water circuit to avoid the risk of freezing if the water flow is shut off for any reason. For a quick connection to the unit the accessory is completed with grooved pipe (on wich install the flow switch) and victaulic bracket.

CR - Remote control (F). This can be used to select all the monitoring and display functions of the control unit on the machine at a maximum distance of 100 meters away. It must be installed by using a cable with three strands or three wires in **PVC** of the **N07-VK** type with a 1mm2 section. The transmission line must be installed in a raceway separate from any electric powering wires (**230/400 V**). The control unit has the following buttons:



MODE key : used to select the operating mode
ON/OFF key : used to turn the unit ON/OFF and to reset the alarms
Mode + ON/OFF keys : used to access and quit the various menu levels
UP key: scrolls forwards through the menu items or increases the value of a parameter
Tasto DOWN: scrolls backwards through the menu items or decreases the value of a parameter.

KOP - Programmer clock (F). Allows the unit to be turned on and off depending on the programmed time setting (up to 14 switching actions can be programmed as required throughout the 7 days of the week).

TAT- High Temperature Thermostat (M). Two thermostats in series on compressors discharge pipes preserve operation not allowing temperature to rise up than a specified fixed value.

INT - Serial interface (M/F). Allows serial communication on RS485 via MODBUS protocol

CSF - Voltage monitor and sequence meter (M/F). The device enables control of the correct sequence of power phases and the lack of any phases. It also ensures that the unit works within ± 10% the rated voltage (MIN=360 V - RATED=400V - MAX=440V). It blocks the unit if the voltage is outside the limits provided for the condensation pressure inside the correct operating limits.

KBT – Low temperature Kit (M). Consisting of antifreeze electrical heaters for plate heat exchangers and oil crankcase heaters for compressors. It is particularly suggested for outdoor installation or indoor installation in rooms that during winter can reach very low ambient temperature

RB- Compressors suction shut-off valve (M). Made by a ball valve installed on compressors suction: allows a quick replacement of the compressor in case of failure.

VER Framework and panels (if present) made by sheet metal with anticorrosion treatment painted RAL7035 with epoxy powders to ensure the maximum resistance to adverse weather conditions.

EEV (M) Electronic Expansion valve (standard for IP and BP units), feeds the evaporator correctly, keeping the selected superheat degree at a steady level; it guarantees an effective and quick response to the load modifications so increasing the efficiency at partial load.

SS - Soft Starter (M). Soft starter on compressors riduce the inrush current and reduce the vibrations transmitted to the pipes and basic frame during the start-up phase.

RIF - Capacitors for power factor corrections (M). Capacitors for power factor corrections increase power factor cos φ (>0.91)

MTC - Magnetothermic switch (M). Magnetothermic switch on all loads in place of fuses.

NOTES: (M): only installed in the factory. **(F):** supplied for installation by the customer.

Other power source voltage rating (contact our technical department).

GENERAL TECHNICAL SPECIFICATION

General technical specifications

MODELS	70.2	80.2	90.2	105.2	120.2	135.2	150.2	170.2	190.2	215.2	240.2	UM
Power supply	400-3-50											V-ph-Hz
Refrigerant type	R410A											-
Compressor specifications												
Type / capacity control	SCROLL (ON-OFF)											-
Starting	Direct											-
Quantity	2											N°
Plant Exchanger												
Type	Aluminum fins and copper tubes											-
PS max. operating pressure	1000											kPa
Quantity	1											N°
Victaulic hydraulic connection	DN65	DN65	DN65	DN65	DN65	DN65	DN65	DN65	DN65	DN65	DN65	DN
Total water capacity	3.9	4.2	4.8	5.5	5.9	6.9	7.5	8.7	9.7	11.2	12.8	l

Electrical specifications

MODELS	70.2	80.2	90.2	105.2	120.2	135.2	150.2	170.2	190.2	215.2	240.2	UM
Total maximum load current [FLA]	45	51	62	68	74	82	90	105	120	142	164	A
Total maximum power input [FLI]	26	29	34	40	45	50	55	63	72	83	93	kW
Total maximum starting current [MIC]	141	166	204	256	262	309	317	355	370	454	476	A

NOMINAL performances - Standard plants

IR unit

MODELS		70.2	80.2	90.2	105.2	120.2	135.2	150.2	170.2	190.2	215.2	240.2	UM
Cooling mode (plant temperature: water in 12°C out 7°C; condensing temperature = 50 °C - subcooling = 5K) PS= 43 bar													
Cooling capacity		61	68	81	92	103	116	130	149	168	190	210	kW
Total power input		19.4	21.4	25.8	29.3	32.9	37.2	41.5	47.2	53.0	59.9	66.8	kW
EER		3.15	3.18	3.14	3.13	3.13	3.12	3.13	3.15	3.17	3.17	3.15	W/W
Plant side	Water flow rate	2.9	3.2	3.9	4.4	4.9	5.5	6.2	7.1	8.0	9.1	10.0	l/s
	Water pressure drop	36	28	31	31	34	32	35	35	37	37	38	kPa

The values are referred to units without options and accessories.

IR-IW UNIT PERFORMANCE

Mod. 70.2 ÷ 105.2

MOD.	TWE	Tc CONDENSING TEMPERATURE (°C)																	
		35			40			45			50			55			60		
		kWf	kWa	kWt	kWf	kWa	kWt	kWf	kWa	kWt	kWf	kWa	kWt	kWf	kWa	kWt	kWf	kWa	kWt
70.2	5	67.5	14.1	80.9	64.2	15.6	79.0	60.9	17.3	77.4	56.9	19.4	75.4	52.7	21.5	73.1	47.7	23.8	70.4
	6	69.8	14.1	83.2	66.5	15.6	81.3	63.1	17.4	79.6	59.0	19.4	77.4	54.6	21.6	75.0	49.4	23.9	72.1
	7	72.2	14.2	85.6	70.1	15.3	84.6	65.2	17.4	81.8	61.0	19.4	79.5	56.4	21.6	76.9	51.2	23.9	73.8
	8	74.5	14.2	88.0	71.1	15.7	86.0	67.4	17.4	84.0	63.1	19.5	81.6	58.3	21.6	78.9	-	-	-
	9	76.8	14.3	90.4	73.4	15.7	88.3	69.6	17.5	86.2	65.1	19.5	83.6	60.2	21.6	80.8	-	-	-
	10	79.1	14.3	92.7	75.6	15.8	90.6	71.8	17.5	88.4	67.1	19.5	85.7	62.1	21.7	82.7	-	-	-
	11	81.5	14.3	95.1	77.9	15.8	93.0	73.9	17.6	90.6	69.2	19.6	87.8	64.0	21.7	84.6	-	-	-
	12	83.8	14.4	97.5	80.2	15.9	95.3	76.1	17.6	92.8	71.2	19.6	89.8	65.9	21.7	86.5	-	-	-
	13	86.1	14.4	99.8	82.5	15.9	97.6	78.3	17.6	95.0	73.2	19.6	91.9	67.8	21.8	88.4	-	-	-
	14	88.5	14.5	102.2	84.8	15.9	99.9	80.5	17.7	97.3	75.3	19.7	94.0	69.6	21.8	90.3	-	-	-
	15	90.8	14.5	104.6	87.1	16.0	102.3	82.6	17.7	99.5	77.3	19.7	96.0	71.5	21.8	92.3	-	-	-
	16	93.1	14.6	107.0	89.4	16.0	104.6	84.8	17.7	101.7	79.3	19.7	98.1	73.4	21.8	94.2	-	-	-
	17	95.5	14.6	109.3	91.7	16.1	106.9	87.0	17.8	103.9	81.4	19.8	100.2	75.3	21.9	96.1	-	-	-
	18	97.8	14.6	111.7	94.0	16.1	109.3	89.2	17.8	106.1	83.4	19.8	102.2	77.2	21.9	98.0	-	-	-
80.2	5	74.8	15.4	89.5	71.3	17.1	87.5	67.7	19.1	85.8	63.4	21.4	83.7	58.7	23.8	81.3	53.4	26.4	78.4
	6	77.3	15.4	92.0	73.7	17.1	90.0	70.1	19.1	88.2	65.7	21.4	86.0	60.9	23.8	83.6	55.4	26.4	80.5
	7	79.8	15.5	94.5	78.8	17.1	95.0	72.5	19.1	90.7	68.0	21.4	88.4	63.1	23.9	85.8	57.5	26.5	82.7
	8	82.3	15.5	97.1	78.7	17.2	95.1	74.9	19.2	93.1	70.3	21.5	90.7	65.3	23.9	88.0	-	-	-
	9	84.8	15.6	99.6	81.2	17.3	97.6	77.3	19.2	95.6	72.6	21.5	93.1	67.5	23.9	90.3	-	-	-
	10	87.3	15.6	102.1	83.7	17.3	100.1	79.7	19.3	98.0	74.9	21.6	95.4	69.7	24.0	92.5	-	-	-
	11	89.8	15.7	104.7	86.1	17.4	102.6	82.1	19.3	100.4	77.2	21.6	97.7	71.9	24.0	94.7	-	-	-
	12	92.3	15.7	107.2	88.6	17.4	105.2	84.5	19.4	102.9	79.5	21.6	100.1	74.1	24.0	97.0	-	-	-
	13	94.8	15.8	109.8	91.1	17.4	107.7	86.9	19.4	105.3	81.8	21.7	102.4	76.3	24.1	99.2	-	-	-
	14	97.3	15.8	112.3	93.6	17.5	110.2	89.3	19.4	107.8	84.1	21.7	104.8	78.5	24.1	101.5	-	-	-
	15	99.7	15.9	114.8	96.1	17.5	112.7	91.7	19.5	110.2	86.4	21.8	107.1	80.7	24.1	103.7	-	-	-
	16	102.2	15.9	117.4	98.6	17.6	115.3	94.1	19.5	112.7	88.8	21.8	109.5	83.0	24.2	105.9	-	-	-
	17	104.7	16.0	119.9	101.0	17.6	117.8	96.5	19.6	115.1	91.1	21.8	111.8	85.2	24.2	108.2	-	-	-
	18	107.2	16.0	122.4	103.5	17.7	120.3	98.9	19.6	117.5	93.4	21.9	114.1	87.4	24.3	110.4	-	-	-
90.2	5	88.6	18.4	106.1	84.5	20.5	104.0	80.5	22.9	102.2	75.6	25.7	100.0	70.3	28.7	97.6	64.2	31.9	94.5
	6	91.4	18.5	108.9	87.3	20.5	106.8	83.2	23.0	105.0	78.3	25.8	102.8	73.0	28.8	100.3	66.8	31.9	97.2
	7	94.1	18.5	111.7	92.7	20.8	112.5	86.0	23.0	107.9	81.0	25.8	105.6	75.7	28.8	103.0	69.5	32.0	99.9
	8	96.9	18.6	114.6	93.0	20.7	112.6	88.8	23.1	110.7	83.8	25.9	108.4	78.4	28.9	105.8	-	-	-
	9	99.7	18.6	117.4	95.8	20.7	115.4	91.6	23.1	113.5	86.5	25.9	111.2	81.0	28.9	108.5	-	-	-
	10	102.5	18.7	120.2	98.6	20.8	118.3	94.3	23.2	116.4	89.2	26.0	113.9	83.7	28.9	111.2	-	-	-
	11	105.3	18.8	123.1	101.4	20.8	121.2	97.1	23.2	119.2	92.0	26.0	116.7	86.4	29.0	114.0	-	-	-
	12	108.0	18.8	125.9	104.2	20.9	124.0	99.9	23.3	122.0	94.7	26.1	119.5	89.1	29.0	116.7	-	-	-
	13	110.8	18.9	128.7	107.0	20.9	126.9	102.7	23.3	124.8	97.4	26.1	122.3	91.8	29.1	119.4	-	-	-
	14	113.6	18.9	131.6	109.8	21.0	129.8	105.4	23.4	127.7	100.2	26.2	125.1	94.5	29.1	122.2	-	-	-
	15	116.4	19.0	134.4	112.6	21.0	132.6	108.2	23.4	130.5	102.9	26.2	127.8	97.2	29.2	124.9	-	-	-
	16	119.2	19.0	137.2	115.5	21.1	135.5	111.0	23.5	133.3	105.6	26.3	130.6	99.8	29.2	127.6	-	-	-
	17	121.9	19.1	140.1	118.3	21.1	138.4	113.8	23.6	136.2	108.4	26.4	133.4	102.5	29.3	130.4	-	-	-
	18	124.7	19.2	142.9	121.1	21.2	141.2	116.5	23.6	139.0	111.1	26.4	136.2	105.2	29.3	133.1	-	-	-
105.2	5	100.7	21.2	120.8	95.9	23.4	118.2	91.2	26.1	116.0	85.5	29.1	113.1	79.3	32.3	110.0	72.2	35.8	106.2
	6	104.0	21.3	124.2	99.3	23.5	121.6	94.5	26.1	119.3	88.7	29.2	116.5	82.5	32.4	113.3	75.3	35.8	109.3
	7	107.3	21.4	127.6	105.8	23.7	128.3	97.8	26.2	122.7	92.0	29.3	119.8	85.7	32.5	116.5	78.4	35.9	112.5
	8	110.7	21.4	131.0	106.0	23.7	128.5	101.1	26.3	126.1	95.2	29.3	123.1	88.8	32.5	119.7	-	-	-
	9	114.0	21.5	134.5	109.4	23.7	131.9	104.4	26.4	129.5	98.4	29.4	126.4	92.0	32.6	123.0	-	-	-
	10	117.3	21.6	137.9	112.7	23.8	135.4	107.7	26.4	132.8	101.7	29.5	129.7	95.1	32.7	126.2	-	-	-
	11	120.7	21.7	141.3	116.1	23.9	138.8	111.0	26.5	136.2	104.9	29.6	133.0	98.3	32.8	129.4	-	-	-
	12	124.0	21.7	144.7	119.5	24.0	142.2	114.3	26.6	139.6	108.2	29.6	136.3	101.5	32.8	132.7	-	-	-
	13	127.3	21.8	148.1	122.8	24.0	145.7	117.6	26.7	143.0	111.4	29.7	139.6	104.6	32.9	135.9	-	-	-
	14	130.7	21.9	151.5	126.2	24.1	149.1	120.9	26.7	146.3	114.6	29.8	142.9	107.8	33.0	139.1	-	-	-
	15	134.0	22.0	154.9	129.6	24.2	152.5	124.2	26.8	149.7	117.9	29.8	146.2	111.0	33.1	142.4	-	-	-
	16	137.4	22.0	158.3	132.9	24.3	156.0	127.5	26.9	153.1	121.1	29.9	149.5	114.1	33.1	145.6	-	-	-
	17	140.7	22.1	161.7	136.3	24.3	159.4	130.9	26.9	156.5	124.3	30.0	152.8	117.3	33.2	148.8	-	-	-
	18	144.0	22.2	165.1	139.6	24.4	162.8	134.2	27.0	159.8	127.6	30.1	156.1	120.5	33.3	152.1	-	-	-

TWE= Plant exchanger (evaporator) outlet water temperature (°C)
Tc= Condensing temperature (°C) - Subcooling = 5K
kWf = Cooling capacity (kW).
kWa = Compressor power input (kW).
kWt = Heating capacity (kW).
The performances refer to a 5°C temperature difference between the water entering and leaving the heat exchanger. Has also been considered A 0.44 x 10^{-4} m^2 K/W fouling factor.

IR-IW UNIT PERFORMANCE

Mod. 120.2 ÷ 170.2

MOD.	TWE	Tc CONDENSING TEMPERATURE (°C)																	
		35			40			45			50			55			60		
		kWf	kWa	kWt	kWf	kWa	kWt	kWf	kWa	kWt	kWf	kWa	kWt	kWf	kWa	kWt	kWf	kWa	kWt
120.2	5	112.8	24.1	135.8	107.4	26.6	132.7	102.0	29.4	130.0	95.6	32.7	126.6	88.6	36.2	122.9	80.5	39.9	118.4
	6	116.7	24.2	139.7	111.3	26.6	136.6	105.9	29.5	133.9	99.3	32.8	130.4	92.2	36.3	126.6	83.9	40.0	121.9
	7	120.6	24.3	143.7	118.9	26.8	144.4	109.7	29.6	137.8	103.0	32.9	134.2	95.7	36.4	130.3	87.4	40.1	125.5
	8	124.5	24.4	147.7	119.1	26.8	144.6	113.5	29.7	141.7	106.7	33.0	138.0	99.3	36.5	134.0	-	-	-
	9	128.4	24.5	151.6	123.1	26.9	148.6	117.3	29.8	145.6	110.4	33.1	141.8	102.9	36.6	137.7	-	-	-
	10	132.3	24.6	155.6	127.0	27.0	152.6	121.1	29.8	149.5	114.1	33.2	145.6	106.5	36.7	141.4	-	-	-
	11	136.2	24.6	159.6	130.9	27.1	156.6	124.9	29.9	153.4	117.8	33.3	149.4	110.1	36.7	145.0	-	-	-
	12	140.1	24.7	163.6	134.8	27.2	160.6	128.8	30.0	157.3	121.5	33.3	153.2	113.7	36.8	148.7	-	-	-
	13	144.0	24.8	167.5	138.7	27.2	164.6	132.6	30.1	161.2	125.3	33.4	157.0	117.3	36.9	152.4	-	-	-
	14	147.9	24.9	171.5	142.6	27.3	168.5	136.4	30.2	165.1	129.0	33.5	160.8	120.9	37.0	156.1	-	-	-
	15	151.8	25.0	175.5	146.5	27.4	172.5	140.2	30.3	169.0	132.7	33.6	164.6	124.5	37.1	159.8	-	-	-
	16	155.7	25.0	179.5	150.4	27.5	176.5	144.0	30.4	172.9	136.4	33.7	168.4	128.1	37.2	163.5	-	-	-
	17	159.6	25.1	183.4	154.3	27.6	180.5	147.8	30.5	176.8	140.1	33.8	172.2	131.7	37.3	167.2	-	-	-
	18	163.5	25.2	187.4	158.2	27.7	184.5	151.7	30.5	180.7	143.8	33.9	176.0	135.3	37.4	170.8	-	-	-
135.2	5	127.1	27.4	153.1	121.1	30.1	149.7	115.1	33.3	146.8	108.0	37.0	143.1	100.2	40.9	139.1	91.3	45.1	134.1
	6	131.5	27.5	157.5	125.5	30.2	154.1	119.4	33.4	151.1	112.0	37.1	147.2	104.1	41.0	143.0	94.9	45.2	137.8
	7	135.8	27.5	162.0	133.8	30.4	162.7	123.6	33.5	155.3	116.0	37.2	151.4	107.9	41.1	146.9	98.5	45.3	141.5
	8	140.2	27.6	166.4	134.2	30.4	163.0	127.8	33.6	159.6	120.1	37.3	155.5	111.7	41.2	150.9	-	-	-
	9	144.6	27.7	170.9	138.5	30.4	167.4	132.0	33.6	163.9	124.1	37.4	159.6	115.6	41.3	154.8	-	-	-
	10	148.9	27.8	175.4	142.8	30.5	171.9	136.2	33.7	168.2	128.1	37.4	163.7	119.4	41.4	158.7	-	-	-
	11	153.3	27.9	179.8	147.2	30.6	176.3	140.4	33.8	172.5	132.2	37.5	167.8	123.3	41.4	162.6	-	-	-
	12	157.7	28.0	184.3	151.5	30.7	180.7	144.6	33.9	176.8	136.2	37.6	171.9	127.1	41.5	166.6	-	-	-
	13	162.0	28.1	188.7	155.9	30.8	185.1	148.8	34.0	181.1	140.2	37.7	176.0	131.0	41.6	170.5	-	-	-
	14	166.4	28.2	193.2	160.2	30.9	189.6	153.0	34.1	185.3	144.2	37.8	180.2	134.8	41.7	174.4	-	-	-
	15	170.8	28.3	197.6	164.6	31.0	194.0	157.2	34.2	189.6	148.3	37.9	184.3	138.6	41.8	178.4	-	-	-
	16	175.2	28.3	202.1	168.9	31.1	198.4	161.4	34.3	193.9	152.3	38.0	188.4	142.5	41.9	182.3	-	-	-
	17	179.5	28.4	206.5	173.3	31.2	202.9	165.6	34.4	198.2	156.3	38.1	192.5	146.3	42.0	186.2	-	-	-
	18	183.9	28.5	211.0	177.6	31.2	207.3	169.8	34.4	202.5	160.4	38.2	196.6	150.2	42.1	190.1	-	-	-
150.2	5	142.6	30.7	171.7	135.9	33.7	167.9	129.3	37.2	164.6	121.3	41.3	160.6	112.7	45.6	156.0	102.7	50.3	150.5
	6	147.4	30.8	176.7	140.7	33.8	172.8	133.9	37.3	169.3	125.7	41.4	165.0	116.8	45.7	160.2	106.6	50.3	154.4
	7	152.2	31.0	181.6	149.8	33.9	182.0	138.5	37.4	174.0	130.0	41.5	169.5	120.9	45.8	164.4	110.4	50.4	158.3
	8	157.1	31.1	186.6	150.3	34.1	182.6	143.1	37.6	178.7	134.4	41.6	174.0	125.1	45.9	168.7	-	-	-
	9	161.9	31.2	191.5	155.1	34.2	187.5	147.7	37.7	183.4	138.8	41.7	178.4	129.2	46.0	172.9	-	-	-
	10	166.7	31.3	196.5	159.8	34.3	192.4	152.3	37.8	188.1	143.2	41.8	182.9	133.3	46.1	177.1	-	-	-
	11	171.6	31.4	201.4	164.6	34.4	197.3	156.9	37.9	192.8	147.5	41.9	187.4	137.4	46.2	181.3	-	-	-
	12	176.4	31.5	206.3	169.4	34.5	202.2	161.5	38.0	197.5	151.9	42.0	191.8	141.6	46.3	185.5	-	-	-
	13	181.2	31.6	211.3	174.2	34.6	207.1	166.1	38.1	202.2	156.3	42.1	196.3	145.7	46.4	189.7	-	-	-
	14	186.1	31.8	216.2	179.0	34.7	212.0	170.7	38.2	206.9	160.7	42.2	200.8	149.8	46.5	194.0	-	-	-
	15	190.9	31.9	221.2	183.8	34.8	216.8	175.3	38.3	211.6	165.0	42.3	205.2	154.0	46.5	198.2	-	-	-
	16	195.7	32.0	226.1	188.6	34.9	221.7	179.8	38.4	216.3	169.4	42.4	209.7	158.1	46.6	202.4	-	-	-
	17	200.6	32.1	231.1	193.3	35.0	226.6	184.4	38.5	221.0	173.8	42.5	214.2	162.2	46.7	206.6	-	-	-
	18	205.4	32.2	236.0	198.1	35.1	231.5	189.0	38.6	225.7	178.1	42.6	218.6	166.3	46.8	210.8	-	-	-
170.2	5	163.1	35.0	196.3	155.5	38.4	192.0	148.0	42.4	188.2	138.9	47.0	183.6	129.1	51.9	178.4	117.8	57.1	172.1
	6	168.6	35.1	202.0	161.0	38.5	197.6	153.3	42.5	193.6	144.0	47.1	188.7	133.9	52.0	183.3	122.3	57.3	176.7
	7	174.2	35.2	207.7	171.7	38.5	208.3	158.6	42.6	199.1	149.0	47.2	193.9	138.7	52.1	188.2	126.7	57.4	181.2
	8	179.8	35.3	213.3	172.1	38.7	208.9	163.9	42.7	204.5	154.1	47.4	199.1	143.5	52.2	193.1	-	-	-
	9	185.3	35.5	219.0	177.6	38.9	214.5	169.2	42.8	209.9	159.1	47.5	204.2	148.2	52.4	198.0	-	-	-
	10	190.9	35.6	224.7	183.1	39.0	220.1	174.5	43.0	215.3	164.2	47.6	209.4	153.0	52.5	202.9	-	-	-
	11	196.5	35.7	230.4	188.6	39.1	225.8	179.8	43.1	220.7	169.2	47.7	214.6	157.8	52.6	207.8	-	-	-
	12	202.1	35.8	236.1	194.1	39.2	231.4	185.1	43.2	226.2	174.3	47.8	219.7	162.6	52.7	212.6	-	-	-
	13	207.6	36.0	241.8	199.7	39.3	237.0	190.4	43.3	231.6	179.4	48.0	224.9	167.4	52.8	217.5	-	-	-
	14	213.2	36.1	247.5	205.2	39.5	242.7	195.7	43.4	237.0	184.4	48.1	230.1	172.1	52.9	222.4	-	-	-
	15	218.8	36.2	253.2	210.7	39.6	248.3	201.0	43.6	242.4	189.5	48.2	235.2	176.9	53.0	227.3	-	-	-
	16	224.3	36.3	258.8	216.2	39.7	253.9	206.4	43.7	247.9	194.5	48.3	240.4	181.7	53.2	232.2	-	-	-
	17	229.9	36.4	264.5	221.7	39.8	259.6	211.7	43.8	253.3	199.6	48.4	245.6	186.5	53.3	237.1	-	-	-
	18	235.5	36.6	270.2	227.3	40.0	265.2	217.0	43.9	258.7	204.6	48.5	250.7	191.2	53.4	242.0	-	-	-

TWE= Plant exchanger (evaporator) outlet water temperature (°C)
Tc= Condensing temperature (°C) - Subcooling = 5K
kWf = Cooling capacity (kW).
kWa = Compressor power input (kW).
kWt = Heating capacity (kW).
The performances refer to a 5°C temperature difference between the water entering and leaving the heat exchanger. Has also been considered A 0.44 x 10^{-4} m^2 K/W fouling factor.

IR-IW UNIT PERFORMANCE

Mod. 190.2 ÷ 240.2

MOD.	TW_E	Tc CONDENSING TEMPERATURE (°C)																	
		35			40			45			50			55			60		
		kWf	kWa	kWt	kWf	kWa	kWt	kWf	kWa	kWt	kWf	kWa	kWt	kWf	kWa	kWt	kWf	kWa	kWt
190.2	5	183.6	39.2	220.8	175.1	43.0	216.0	166.6	47.5	211.8	156.5	52.7	206.6	145.5	58.2	200.8	132.8	64.1	193.7
	6	190.0	39.3	227.3	181.4	43.1	222.4	172.7	47.6	217.9	162.2	52.9	212.5	150.9	58.4	206.4	137.9	64.3	198.9
	7	196.3	39.4	233.8	193.8	43.2	234.8	178.8	47.8	224.1	168.0	53.0	218.4	156.4	58.5	211.9	142.9	64.4	204.1
	8	202.7	39.6	240.3	194.0	43.4	235.3	184.8	47.9	230.3	173.8	53.1	224.3	161.8	58.6	217.5	-	-	-
	9	209.1	39.7	246.8	200.3	43.5	241.7	190.9	48.0	236.5	179.5	53.3	230.1	167.3	58.8	223.1	-	-	-
	10	215.4	39.8	253.3	206.6	43.7	248.1	196.9	48.2	242.7	185.3	53.4	236.0	172.7	58.9	228.7	-	-	-
	11	221.8	40.0	259.8	212.9	43.8	254.6	203.0	48.3	248.9	191.1	53.5	241.9	178.1	59.1	234.2	-	-	-
	12	228.2	40.1	266.3	219.3	43.9	261.0	209.1	48.4	255.1	196.8	53.7	247.8	183.6	59.2	239.8	-	-	-
	13	234.6	40.2	272.8	225.6	44.1	267.4	215.1	48.6	261.3	202.6	53.8	253.7	189.0	59.3	245.4	-	-	-
	14	240.9	40.4	279.3	231.9	44.2	273.8	221.2	48.7	267.5	208.4	54.0	259.6	194.5	59.5	251.0	-	-	-
	15	247.3	40.5	285.8	238.2	44.3	280.3	227.2	48.8	273.6	214.1	54.1	265.5	199.9	59.6	256.5	-	-	-
	16	253.7	40.6	292.3	244.5	44.5	286.7	233.3	49.0	279.8	219.9	54.2	271.4	205.4	59.8	262.1	-	-	-
	17	260.1	40.8	298.8	250.8	44.6	293.1	239.4	49.1	286.0	225.6	54.4	277.3	210.8	59.9	267.7	-	-	-
	18	266.4	40.9	305.3	257.1	44.7	299.6	245.4	49.3	292.2	231.4	54.5	283.2	216.2	60.0	273.3	-	-	-
215.2	5	207.7	44.1	249.6	198.1	48.5	244.2	188.5	53.6	239.5	177.0	59.6	233.7	164.5	65.9	227.2	150.2	72.7	219.2
	6	214.9	44.3	256.9	205.2	48.7	251.4	195.3	53.8	246.4	183.5	59.8	240.3	170.7	66.1	233.4	155.9	72.8	225.1
	7	222.0	44.4	264.2	219.0	49.4	265.9	202.1	54.0	253.4	190.0	59.9	246.9	176.8	66.2	239.7	161.6	73.0	230.9
	8	229.2	44.6	271.5	219.4	49.0	265.9	209.0	54.1	260.4	196.5	60.1	253.5	182.9	66.4	246.0	-	-	-
	9	236.3	44.8	278.8	226.4	49.1	273.1	215.8	54.3	267.3	202.9	60.2	260.2	189.0	66.5	252.2	-	-	-
	10	243.5	44.9	286.1	233.5	49.3	280.3	222.6	54.4	274.3	209.4	60.4	266.8	195.2	66.7	258.5	-	-	-
	11	250.6	45.1	293.4	240.6	49.4	287.6	229.4	54.6	281.2	215.9	60.5	273.4	201.3	66.8	264.8	-	-	-
	12	257.8	45.2	300.7	247.7	49.6	294.8	236.2	54.7	288.2	222.4	60.7	280.0	207.4	67.0	271.0	-	-	-
	13	264.9	45.4	308.0	254.8	49.7	302.0	243.0	54.9	295.1	228.8	60.9	286.7	213.5	67.1	277.3	-	-	-
	14	272.1	45.5	315.4	261.9	49.9	309.3	249.8	55.0	302.1	235.3	61.0	293.3	219.7	67.3	283.6	-	-	-
	15	279.2	45.7	322.7	268.9	50.1	316.5	256.6	55.2	309.0	241.8	61.2	299.9	225.8	67.4	289.8	-	-	-
	16	286.4	45.8	330.0	276.0	50.2	323.7	263.4	55.3	316.0	248.3	61.3	306.5	231.9	67.6	296.1	-	-	-
	17	293.6	46.0	337.3	283.1	50.4	331.0	270.2	55.5	323.0	254.8	61.5	313.2	238.0	67.8	302.4	-	-	-
	18	300.7	46.2	344.6	290.2	50.5	338.2	277.0	55.7	329.9	261.2	61.6	319.8	244.1	67.9	308.7	-	-	-
240.2	5	229.3	49.0	275.9	218.8	53.9	270.0	208.3	59.7	265.0	195.6	66.5	258.8	182.0	73.6	251.9	166.2	81.2	243.3
	6	237.2	49.2	284.0	226.6	54.1	278.0	215.8	59.9	272.7	202.8	66.7	266.1	188.7	73.8	258.8	172.5	81.4	249.8
	7	245.1	49.4	292.0	240.8	55.6	293.6	223.3	60.1	280.4	210.0	66.8	273.5	195.5	73.9	265.7	178.8	81.6	256.3
	8	253.1	49.5	300.1	242.3	54.5	294.0	230.9	60.3	288.1	217.1	67.0	280.8	202.3	74.1	272.7	-	-	-
	9	261.0	49.7	308.2	250.1	54.6	302.0	238.4	60.4	295.8	224.3	67.2	288.1	209.0	74.3	279.6	-	-	-
	10	268.9	49.9	316.3	258.0	54.8	310.0	245.9	60.6	303.5	231.4	67.4	295.5	215.8	74.5	286.5	-	-	-
	11	276.8	50.0	324.4	265.8	55.0	318.0	253.4	60.8	311.2	238.6	67.6	302.8	222.5	74.7	293.5	-	-	-
	12	284.7	50.2	332.4	273.6	55.2	326.0	261.0	61.0	318.9	245.8	67.7	310.1	229.3	74.8	300.4	-	-	-
	13	292.7	50.4	340.5	281.5	55.3	334.0	268.5	61.1	326.6	252.9	67.9	317.4	236.1	75.0	307.3	-	-	-
	14	300.6	50.6	348.6	289.3	55.5	342.0	276.0	61.3	334.3	260.1	68.1	324.8	242.8	75.2	314.3	-	-	-
	15	308.5	50.7	356.7	297.1	55.7	350.0	283.6	61.5	342.0	267.3	68.3	332.1	249.6	75.4	321.2	-	-	-
	16	316.4	50.9	364.8	305.0	55.8	358.0	291.1	61.7	349.7	274.4	68.4	339.4	256.4	75.6	328.1	-	-	-
	17	324.3	51.1	372.8	312.8	56.0	366.0	298.6	61.8	357.4	281.6	68.6	346.8	263.1	75.7	335.1	-	-	-
	18	332.2	51.2	380.9	320.6	56.2	374.0	306.1	62.0	365.1	288.7	68.8	354.1	269.9	75.9	342.0	-	-	-

TW_E= Plant exchanger (evaporator) outlet water temperature (°C)
Tc= Condensing temperature (°C) - Subcooling = 5K
kWf = Cooling capacity (kW).
kWa = Compressor power input (kW).
kWt = Heating capacity (kW).
The performances refer to a 5°C temperature difference between the water entering and leaving the heat exchanger. Has also been considered A 0.44 x 10^{-4} m^2 K/W fouling factor.

CORRECTION FACTOR

Correction factor for the use of glycol in cooling mode

ETHYLENE GLYCOL with water produced between 5 ÷ 20 ° C.

Percentage Of glycol in mass / volume [%]	**0 / 0**	**10 / 8.9**	**20 / 18.1**	**30 / 27.7**	**40 / 37.5**
Freezing point [°C]	0	-3.2	-8	-14	-22
CCPF - Cooling capacity correction factor	1	0.99	0.98	0.97	0.95
CCPA - Power input correction factor	1	1	0.99	0.99	0.98
CCQA - Water flow rate correction factor	1	1.04	1.08	1.12	1.16
CCDP - Water pressure drop correction factor	1	1.08	1.16	1.25	1.35

PROPYLENE GLYCOL with water produced between 5 ÷ 20 ° C.

Percentage Of glycol in mass / volume [%]	**0 / 0**	**10 / 9.6**	**20 / 19.4**	**30 / 29.4**	**40 / 39.6**
Freezing point [°C]	0	-3.3	-7	-13	-21
CCPF - Cooling capacity correction factor	1	0.98	0.96	0.94	0.92
CCPA - Power input correction factor	1	0.99	0.98	0.95	0.93
CCQA - Water flow rate correction factor	1	1.01	1.03	1.06	1.09
CCDP - Water pressure drop correction factor	1	1.05	1.11	1.22	1.38

Basing on design condensing temperature and leaving water temperature of the plant exchanger (evaporator) (DESIGN CONDITIONS) from the table “performances” extract Cooling Capacity (kWf) and Compressors Power Input (kWa).
Based on type and percentage of glycol extract CCPF, CCPA, CCQA, CCDP.
Then calculate.

Pf_brine = kWf x CCPF
Pass_CP_brine = kWa x CCPA

Then calculate brine flow rate of the plant exchanger (evaporator):

*Q_brine [l/s]=CCQA x (Pf_brine [kW]*0.86/∆T_brine)/3.6*

where ∆T_brine is the difference inlet-outlet plant exchanger (evaporator) water temperature:

∆T_brine=Twin_brine-Twout_brine

With this brine flow rate enter in abscissa on the water pressure drop of the plant exchanger (evaporator) then you have ∆p_app.
Finally you can calculate the actual pressure drop of the brine on plant exchanger (evaporator) side:

∆p_brine =CCDP x ∆p_app

Fouling factors

The performances supplied with the tables are referred to a fouling factory = 0.44×10^{-4} m² K/W . For different values of the fouling factory, use the reduction coefficients reported in the following table.

Fouling factory		**Evaporator**	
		F.c. PF	**F.c. PA**
(m² K / W)	**0.44×10^{-4}**	**1**	**1**
(m² K / W)	0.86×10^{-4}	0.98	0.99
(m² K / W)	1.72×10^{-4}	0.93	0.98

F.c. PF: Correction Factor for Cooling capacity
F.c. PA: Correction Factor for compressor power Input

BRINE UNIT BR

Brine Unit (BR)

Correction factors to apply to the basic version data

ETHYLENE GLYCOL

Percentage Of glycol in mass / volume [%]	20 / 18.1						
Freezing point [°C]	-8						
Leaving water temperature	4	2	0	-2	-4	-6	-8
CCPF - Cooling capacity correction factor	0.912	0.855	0.798	0.738	0.683	-	-
CCPA - Compressor power input correction factor	0.967	0.957	0.947	0.927	0.897	-	-
CCQA - Water flow rate correction factor	1.071	1.072	1.073	1.075	1.076	-	-
CCDP - Water pressure drop correction factor	1.090	1.095	1.100	1.110	1.120	-	-

Percentage Of glycol in mass / volume [%]	30 / 27.7						
Freezing point [°C]	-14						
Leaving water temperature	4	2	0	-2	-4	-6	-8
CCPF - Cooling capacity correction factor	0.899	0.842	0.785	0.725	0.670	0.613	0.562
CCPA - Compressor power input correction factor	0.960	0.950	0.940	0.920	0.890	0.870	0.840
CCQA - Water flow rate correction factor	1.106	1.107	1.108	1.109	1.110	1.111	1.112
CCDP - Water pressure drop correction factor	1.140	1.145	1.150	1.155	1.160	1.175	1.190

Percentage Of glycol in mass / volume [%]	40 / 37.5						
Freezing point [°C]	-22						
Leaving water temperature	4	2	0	-2	-4	-6	-8
CCPF - Cooling capacity correction factor	0.884	0.827	0.770	0.710	0.655	0.598	0.547
CCPA - Compressor power input correction factor	0.880	0.870	0.860	0.840	0.810	0.790	0.760
CCQA - Water flow rate correction factor	1.150	1.151	1.153	1.154	1.155	1.157	1.158
CCDP - Water pressure drop correction factor	1.190	1.195	1.200	1.210	1.220	1.235	1.250

PROPYLENE GLYCOL

Percentage Of glycol in mass / volume [%]	20 / 19.4						
Freezing point [°C]	-8						
Leaving water temperature	4	2	0	-2	-4	-6	-8
CCPF - Cooling capacity correction factor	0.874	0.807	0.740	0.690	0.641	-	-
CCPA - Compressor power input correction factor	0.945	0.935	0.925	0.900	0.875	-	-
CCQA - Water flow rate correction factor	1.037	1.038	1.039	1.039	1.040	-	-
CCDP - Water pressure drop correction factor	1.110	1.115	1.120	1.130	1.140	-	-

Percentage Of glycol in mass / volume [%]	30 / 29.4						
Freezing point [°C]	-14						
Leaving water temperature	4	2	0	-2	-4	-6	-8
CCPF - Cooling capacity correction factor	0.869	0.799	0.729	0.680	0.630	0.583	0.536
CCPA - Compressor power input correction factor	0.935	0.923	0.910	0.888	0.865	0.838	0.810
CCQA - Water flow rate correction factor	1.072	1.071	1.070	1.069	1.069	1.068	1.067
CCDP - Water pressure drop correction factor	1.160	1.175	1.190	1.200	1.210	1.255	1.300

Percentage Of glycol in mass / volume [%]	40 / 39.6						
Freezing point [°C]	-22						
Leaving water temperature	4	2	0	-2	-4	-6	-8
CCPF - Cooling capacity correction factor	0.848	0.784	0.719	0.670	0.620	0.570	0.520
CCPA - Compressor power input correction factor	0.865	0.855	0.845	0.820	0.795	0.773	0.750
CCQA - Water flow rate correction factor	1.116	1.114	1.112	1.110	1.108	1.107	1.105
CCDP - Water pressure drop correction factor	1.230	1.275	1.320	1.375	1.430	1.500	1.570

Basing on design condensing temperature and with leaving water temperature of the plant exchanger (evaporator) = 7°C from the table “performances” extract Cooling Capacity (kWf) and Compressors Power Input (kWa).
Based on type and percentage of glycol extract CCPF, CCPA, CCQA, CCDP.
Then calculate.

Pf_brine = kWf x CCPF

Pass_CP_brine = kWa x CCPA

Then calculate brine flow rate:

*Q_brine [l/s]=CCQA x (Pf_brine [kW]*0.86/∆T_brine)/3.6*

where ∆T_brine is the difference between inlet-outlet plant exchanger (evaporator) water temperature:

∆T_brine=Twin_brine-Twout_brine

With this brine flow rate enter in abscissa on the water pressure drop of the plant exchanger (evaporator) then you have Dp_app.
Finally you can calculate the actual pressure drop of the brine on plant exchanger (evaporator) side:

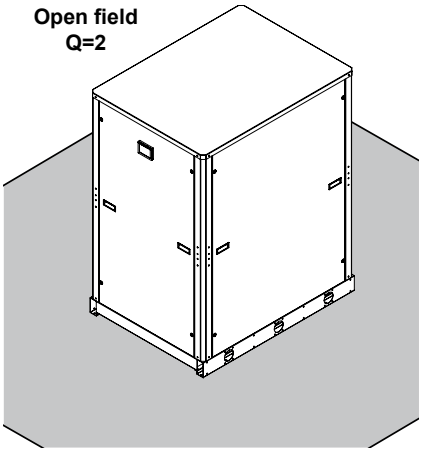
Dp_brine =CCDP x Dp_app

NOISE LEVEL

The noise levels refer to units operating in the nominal conditions (water temperature: inlet: 12°C - outlet: 7°C, Condenser water temperature: inlet: 30°C - outlet: 35°C).
The acoustic pressure levels are measured 1/ 5 / 10 meters away from the outer surface of the unit operating in the free field and resting on a reflecting surface (directional factor of 2).

SWL = Sound power levels, with reference to $1x10^{-12}$ W.
The Total sound power level in dB(A) measured in compliance with ISO 9614 standards, which is therefore the only binding acoustic specification (the values of the Octave bands in the table are indicative).

SPL = Sound pressure levels, with reference to $2x10^{-5}$ Pa.
The sound pressure levels are values calculated by applying the **ISO-3744 relation (Eurovent 8/1)** and refer to a distance of 1 meter away from the external surface of units operating in the open field with directivity factor 2 (Q=2) and the units operating in nominal conditions in the cooling mode.



AB Standard unit

MOD.	SWL (dB)										SPL [dB(A)]		
	Octave bands (Hz)								Total				
	63	125	250	500	1000	2000	4000	8000	dB	dB(A)	1 m	5 m	10 m
70.2	76	74	71	72	72	65	61	55	80.6	**75**	59	49	44
80.2	76	74	75	74	70	68	64	53	81.5	**76**	60	50	45
90.2	77	75	76	75	71	69	65	54	82.5	**77**	61	51	46
105.2	77	75	76	75	71	69	65	54	82.5	**77**	61	51	46
120.2	77	75	76	75	71	69	65	54	82.5	**77**	61	51	46
135.2	78	76	77	76	72	70	66	55	83.5	**78**	62	52	47
150.2	78	76	77	76	72	70	66	55	83.5	**78**	62	52	47
170.2	79	77	78	77	73	71	67	56	84.5	**79**	63	53	48
190.2	79	77	78	77	73	71	67	56	84.5	**79**	63	53	48
215.2	80	78	79	78	74	72	68	57	85.5	**80**	64	54	49
240.2	80	78	79	78	74	72	68	57	85.5	**80**	64	54	49

AS Low noise unit

MOD.	SWL (dB)										SPL [dB(A)]		
	Octave bands (Hz)								Total				
	63	125	250	500	1000	2000	4000	8000	dB	dB(A)	1 m	5 m	10 m
70.2	72	70	67	68	68	61	57	51	76.6	**71**	55	45	40
80.2	72	70	71	70	66	64	60	49	77.5	**72**	56	46	41
90.2	73	71	72	71	67	65	61	50	78.5	**73**	57	47	42
105.2	73	71	72	71	67	65	61	50	78.5	**73**	57	47	42
120.2	73	71	72	71	67	65	61	50	78.5	**73**	57	47	42
135.2	74	72	73	72	68	66	62	51	79.5	**74**	58	48	43
150.2	74	72	73	72	68	66	62	51	79.5	**74**	58	48	43
170.2	75	73	74	73	69	67	63	52	80.5	**75**	59	49	44
190.2	75	73	74	73	69	67	63	52	80.5	**75**	59	49	44
215.2	76	74	75	74	70	68	64	53	81.5	**76**	60	50	45
240.2	76	74	75	74	70	68	64	53	81.5	**76**	60	50	45

AX Extra low noise unit

MOD.	SWL (dB)										SPL [dB(A)]		
	Octave bands (Hz)								Total				
	63	125	250	500	1000	2000	4000	8000	dB	dB(A)	1 m	5 m	10 m
70.2	68	66	63	64	64	57	53	47	72.6	**67**	51	41	36
80.2	68	66	67	66	62	60	56	45	73.5	**68**	52	42	37
90.2	69	67	68	67	63	61	57	46	74.5	**69**	53	43	38
105.2	69	67	68	67	63	61	57	46	74.5	**69**	53	43	38
120.2	69	67	68	67	63	61	57	46	74.5	**69**	53	43	38
135.2	70	68	69	68	64	62	58	47	75.5	**70**	54	44	39
150.2	70	68	69	68	64	62	58	47	75.5	**70**	54	44	39
170.2	71	69	70	69	65	63	59	48	76.5	**71**	55	45	40
190.2	71	69	70	69	65	63	59	48	76.5	**71**	55	45	40
215.2	72	70	71	70	66	64	60	49	77.5	**72**	56	46	41
240.2	72	70	71	70	66	64	60	49	77.5	**72**	56	46	41

OPERATING RANGE

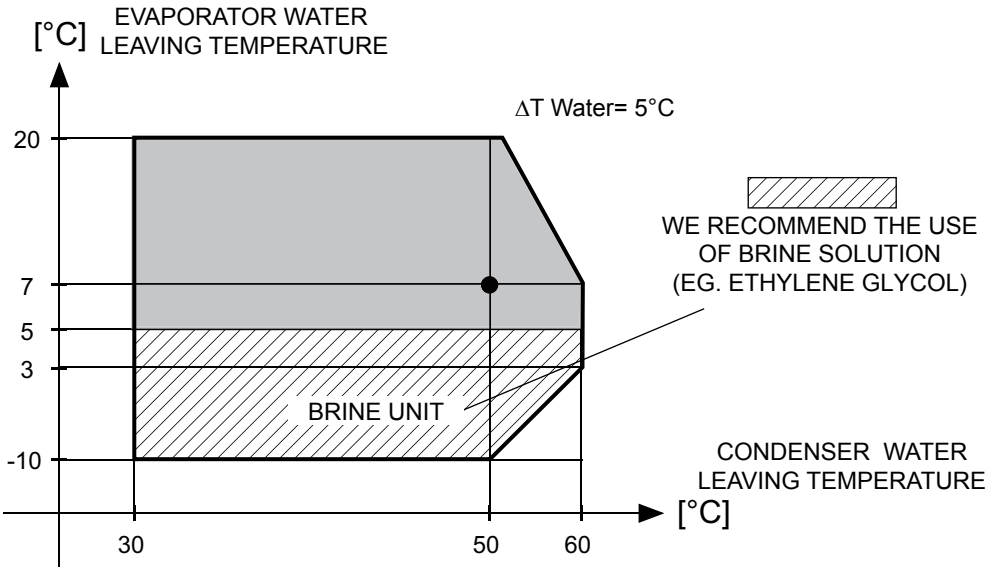
Operating range

The graph indicates the admissible working envelope of the unit.
The use of the unit in conditions outside the envelope will avoid the warranty.
Here under are reported the limits of water differential temperature for the heat exchangers of the unit.

Operating range standard unit AB

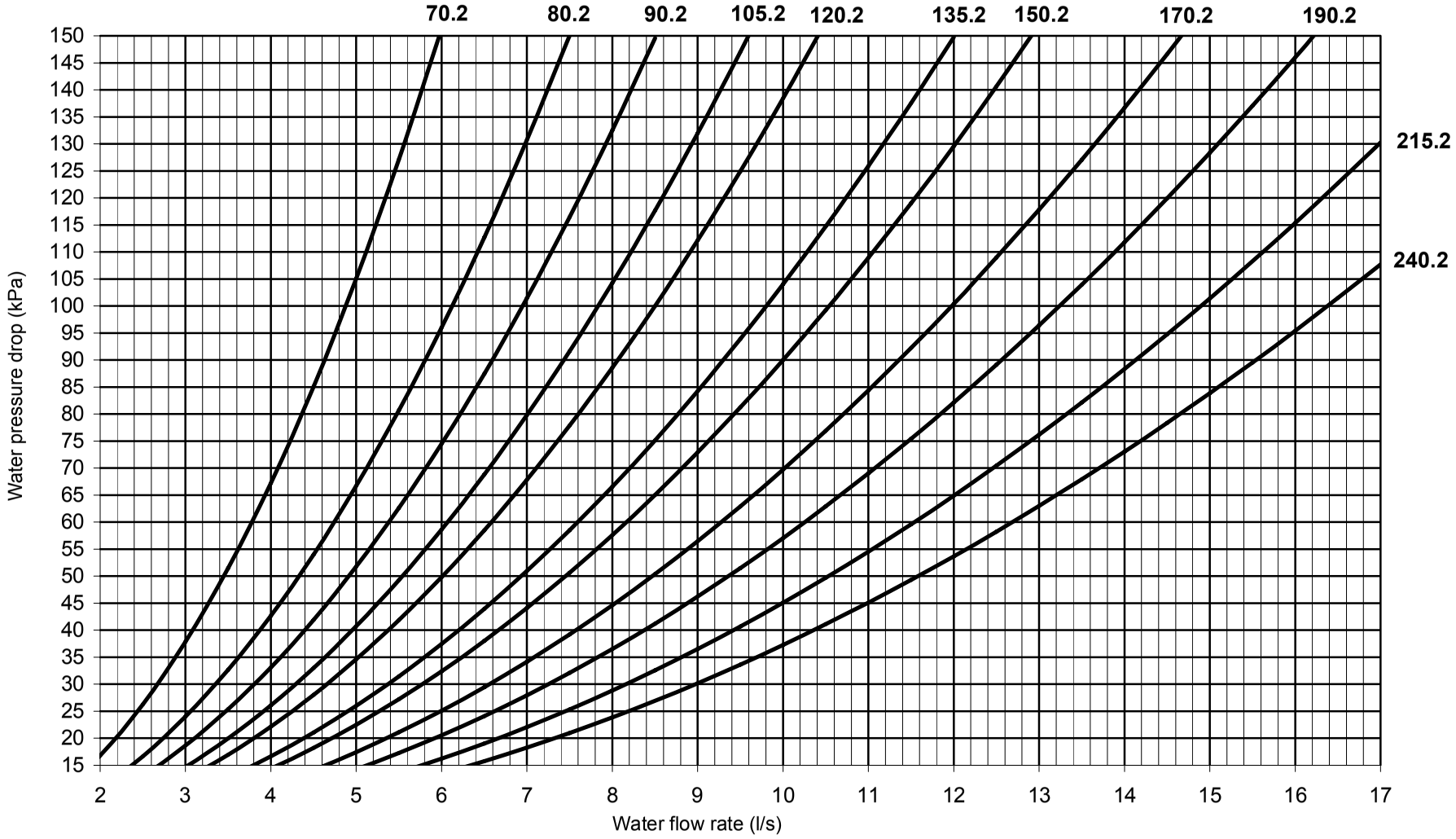
Water thermal gradient		Limit value
		Plant exchanger
Minimum	°C	3
Maximum	°C	10
		Verify that water flow rate is inside the admissible limits.

NOTE: the admissible limits for water flow rate on heat exchangers are indicated under the related pressure drop graph (see section "water pressure drop").



Plant exchanger

The graph below illustrates for the plant exchanger the water pressure drop values in kPa depending on the flow rate in liters/second. The operating range is delimited by the minimum and maximum values given in the next table.



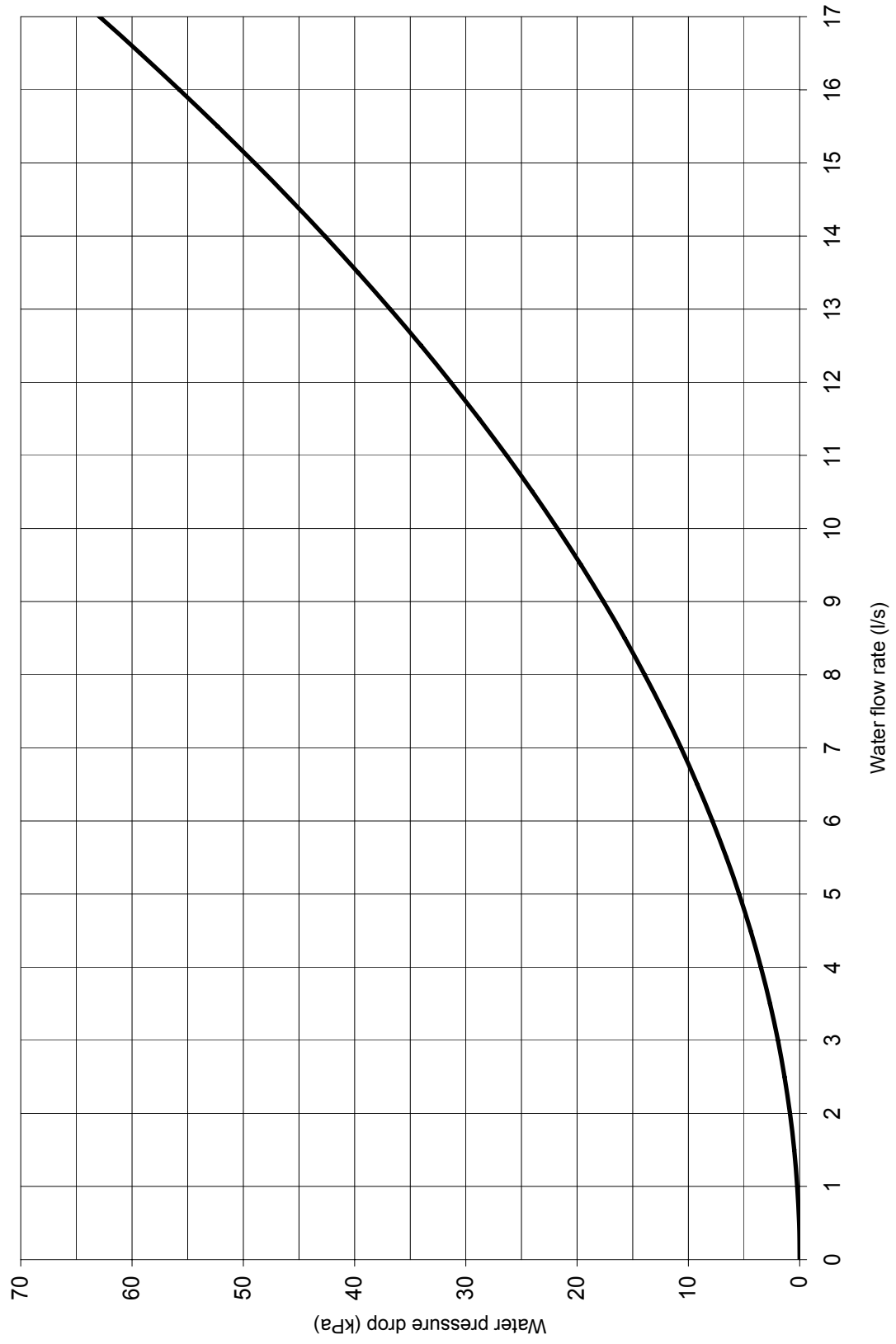
Operating range

MODELS		70.2	80.2	90.2	105.2	120.2	135.2	150.2	170.2	190.2	215.2	240.2	UM	NOTES
Lower limit value	Q	2.00	2.37	2.69	3.03	3.29	3.80	4.08	4.64	5.13	5.77	6.34	Q	Q=Water flow rate
Upper limit value	Q	5.97	7.50	8.51	9.60	10.41	12.01	12.91	14.67	16.22	17.00	17.00	Q	

WATER PRESSURE DROP

Water filter

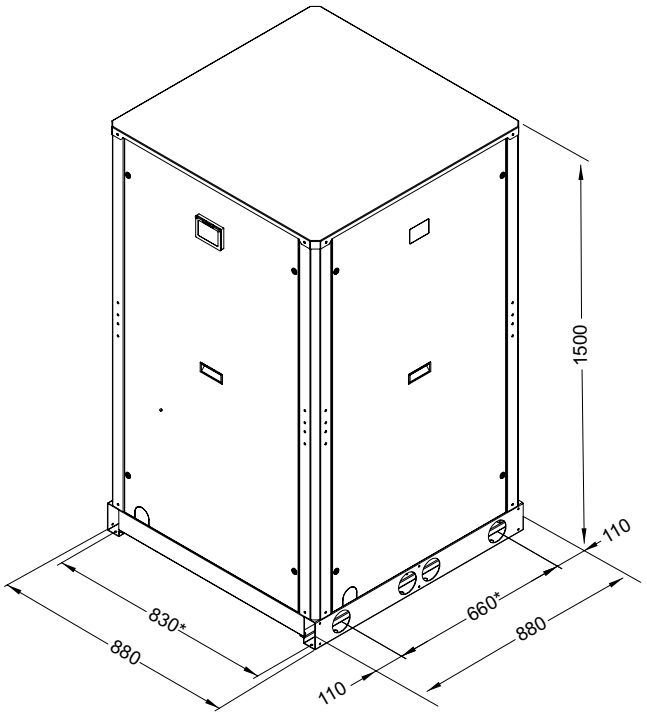
The following graph shows the water filter pressure drop values in kPa as a function of flow rate in litres/second.



DIMENSIONAL DATA

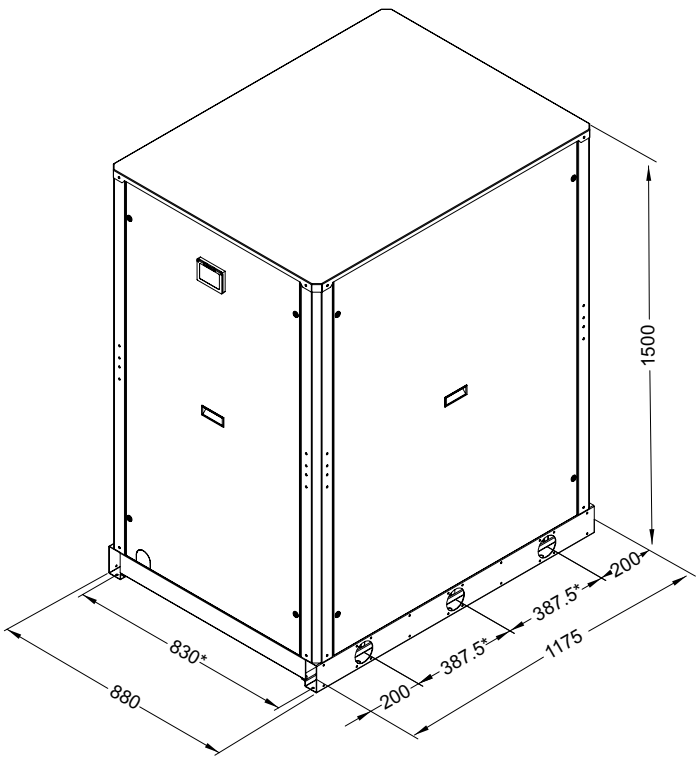
Standard unit overall dimension

FRAME 1
(Mod. 70.2 ÷ 90.2)



*** :** Center distance of vibration damper holes and lifting holes
ø 14 mm Vibration damper fixing holes
ø 75 mm lifting holes

FRAME 2
(Mod. 105.2 ÷ 240.2)



*** :** Center distance of vibration damper holes and lifting holes
ø 14 mm Vibration damper fixing holes
ø 75 mm lifting holes

Shipping weight

Mod.	70.2	80.2	90.2	105.2	120.2	135.2	150.2	170.2	190.2	215.2	240.2	**UM**
AB Standard unit	290	300	306	403	482	508	532	568	592	621	642	kg
AS Low noise unit	340	350	356	465	545	571	594	630	654	683	705	kg
AX Extra low noise unit	364	374	380	495	575	601	624	660	684	713	735	kg

Operation weight

Mod.	70.2	80.2	90.2	105.2	120.2	135.2	150.2	170.2	190.2	215.2	240.2	**UM**
AB Standard unit	294	304	311	409	488	515	540	577	602	632	655	kg
AS Low noise unit	344	354	361	471	551	577	602	639	664	694	717	kg
AX Extra low noise unit	368	378	385	501	581	607	632	669	694	724	747	kg

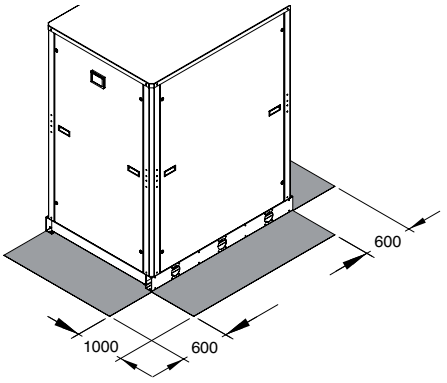
DIMENSIONAL DATA

Minimum space for operation

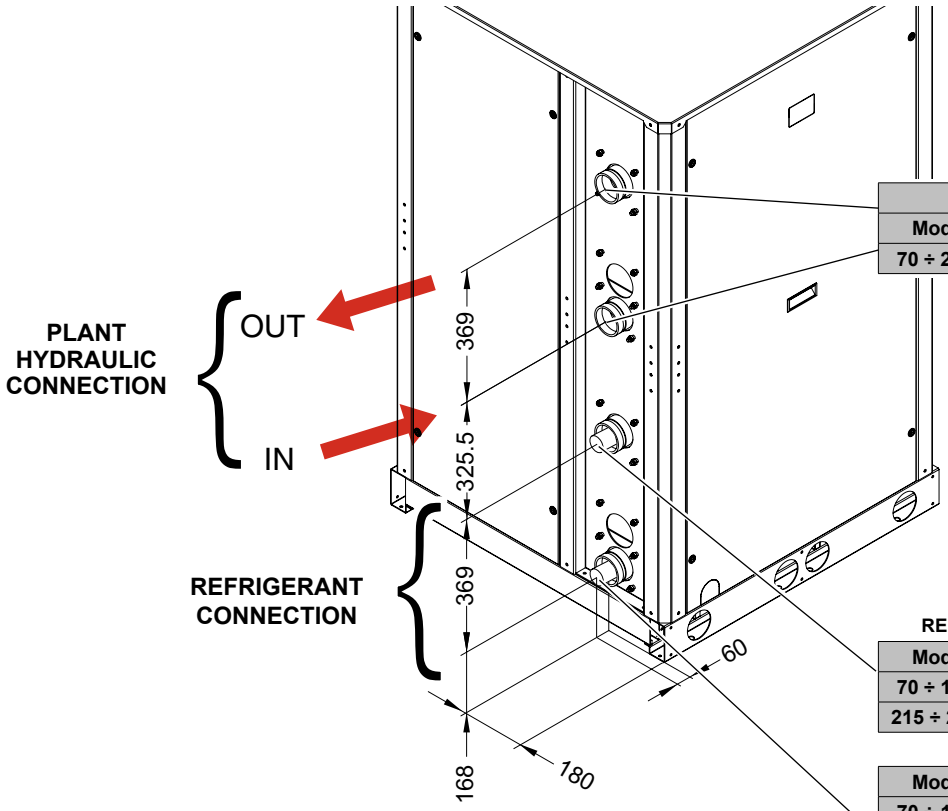
Refer to the figure alongside for the dimensions of the unit.
To correctly install the unit, comply with the measurements for the free area that must be left around the machine, as shown in the figure. The distances must be doubled if the unit is to be installed in a pit.

NOTE: Allow for a clear area of not less than 0.5 meters above unit.

The areas installation must be doubled if multiple units are installed.



Refrigerant and hydraulic connections



HYDRAULIC CONNECTION

PLANT			
Mod.	**Ø**	**DN**	**Type**
70 ÷ 240	2 ½"	DN65	Victaulic

REFRIGERANT CONNECTION

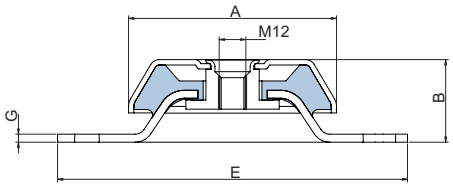
Mod.	DISCHARGE	UM
70 ÷ 190	42 ODS	mm
215 ÷ 240	42 ODS	mm

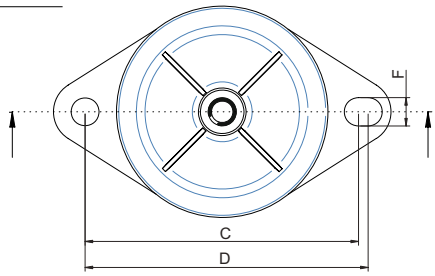
Mod.	LIQUID	UM
70 ÷ 190	28 ODS	mm
215 ÷ 240	35 ODS	mm

NB.: The measures are in mm.

Vibration-damper installation

To prevent the operating unit from transmitting vibrations to the bearing structure, vibration dampening materials should be inserted under the bearing points.
The unit can be supplied with the rubber or spring vibration dampening accessory. This must be mounted by the installer.





Mod.	A	B	C	D	E	G	F	UM
70.2 ÷ 240.2	95	35	122	124	150	3	10	mm

REMOTE AXIAL CONDENSER ACCESSORIES - RC

Description

This new series of Remote Axial Condensers uses copper pipes with special internal riffling and a high efficiency fin,

The fin has been specially designed to guarantee a high thermal exchange coefficient
with low air pressure drops. By combining both special tubes and fins the following features can be achieved:
- Maximum capacity related to the heat exchanger's dimensions.
- Minimum refrigerant charge.
- The most strict environment standards for sound pollution can be met.

This new series of axial condensers is equipped with fans with scythe-shaped blades to reduce the sound emission. From the noise level point of view, all models can be supplied as basic version (AB), low noise version (AS) or extra low noise version (AX).

To guarantee solidity, strength and the maximum resistance to atmospheric agents the bearing and the casing are manufactured with galvanized steel and oven painted with a polyurethane resin (the standard colour is RAL 7035).

All models can be equipped with several accessories as:
- Condensing Control using a cut of phase regulator (AB e AS), by step (AX)
- Electrical Wiring Box, allows a fast and safe electrical installation of the unit since all wires and thermal protections of the fans are connected inside a waterproof box (IP54) to a terminal block where the installer connect the electrical supply (400V-3+PE-50Hz) and the fans thermal switches signal.
- Electrical Panel CE this accessory (like the electrical wiring box) allows a fast and safe electrical installation and moreover simplify the standard and non standard maintenance of the unit.
The accessory is in fact composed by main electrical switch, fuses and contactors of the fans, transformer to supply an alarm auxiliary relè, terminal block for remote ON-OFF (i.e. sent by the condenserless unit)
- Rubber Vibrations Dampers
- Support Brackets

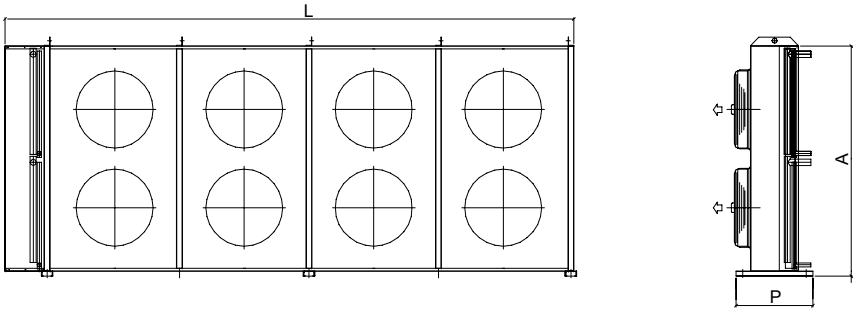
As special options it is possible supply:
- Special fins (Copper, Painted Aluminium, ecc.).
- Special motors

REMOTE AXIAL CONDENSER ACCESSORIES - RC

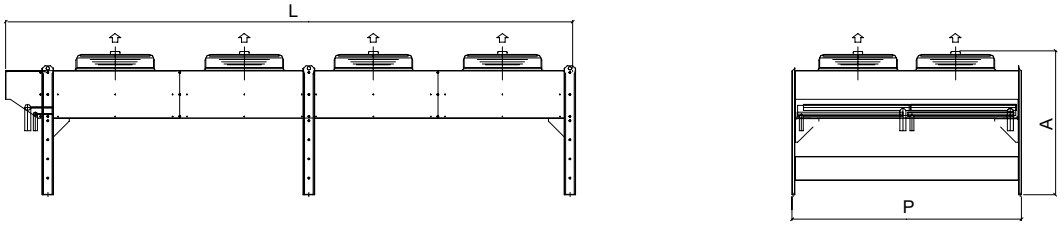
AB Basic Version

Models	70.2	80.2	90.2	105.2	120.2	135.2	150.2	170.2	190.2	215.2	240.2	UM
Power supply	400-3+PE-50											V-ph-Hz
Refrigerant	R410A											-
Max working pressure (PS)	45											bar
Coils type	Aluminum fins and copper tubes											-
Gas connections	1x42	1x42	1x42	1x42	1x42	1x42	1x42	1x42	1x54	1x54	1x54	n° x Ø
Liquid connections	1x35	1x35	1x35	1x28	1x35	1x35	1x35	1x35	1x42	1x42	1x42	n° x Ø
Fan specification												
Fan	2	2	3	2	2	2	2	3	3	3	3	n°
Diameter	630	630	630	800	800	800	800	800	800	800	800	mm
Air flow rate	20000	20000	32100	42400	39200	39200	36800	63600	58800	55200	55200	l/s
Power input	1.46	1.46	2.19	4	4	4	4	6	6	6	6	kW
Current input	2.7	2.7	4.05	8.6	8.6	8.6	8.6	12.9	12.9	12.9	12.9	A
Internal volume	21	21	21	18	27	27	35	27	41	53	53	dm^3
Weight	166	166	221	279	302	302	324	413	447	481	481	kg
Standard configuration Dimension (horizontal air flow)												
Length [L]	2630	2630	3770	3230	3230	3230	3230	4580	4580	4580	4580	mm
height [A]	1230	1230	1230	1370	1370	1370	1370	1370	1370	1370	1370	mm
depth [P]	600	600	600	800	800	800	800	800	800	800	800	mm
Dimension with Configuration with Support Brackets accessories (vertical air flow)												
Length [L]	2630	2630	3770	3230	3230	3230	3230	4580	4580	4580	4580	mm
height [A]	990	990	990	1565	1565	1565	1565	1565	1565	1565	1565	mm
depth [P]	1230	1230	1230	1370	1370	1370	1370	1370	1370	1370	1370	mm
Noise level												
Sound Power Level	80	80	82	83	83	83	83	85	85	85	85	dB(A)
Sound pressure level at 1mt	63	63	65	66	66	66	66	68	68	68	68	dB(A)
Sound pressure level at 5mt	53	53	55	56	56	56	56	58	58	58	58	dB(A)
Sound pressure level at 10mt	48	48	50	51	51	51	51	53	53	53	53	dB(A)

Standard configuration type 1 (horizontal air flow)



Configuration with Support Brackets accessories Type 3 (vertical air flow)

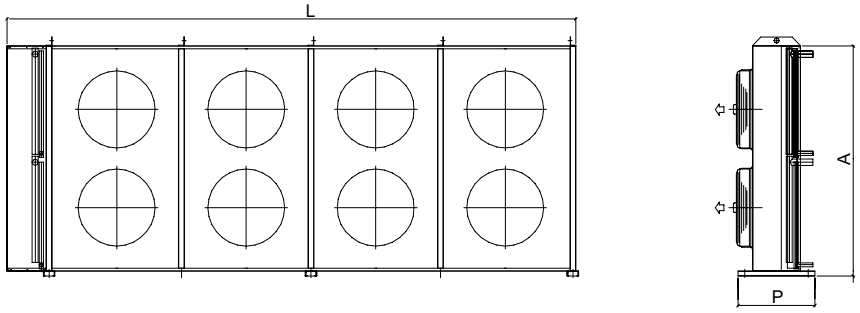


REMOTE AXIAL CONDENSER ACCESSORIES - RC

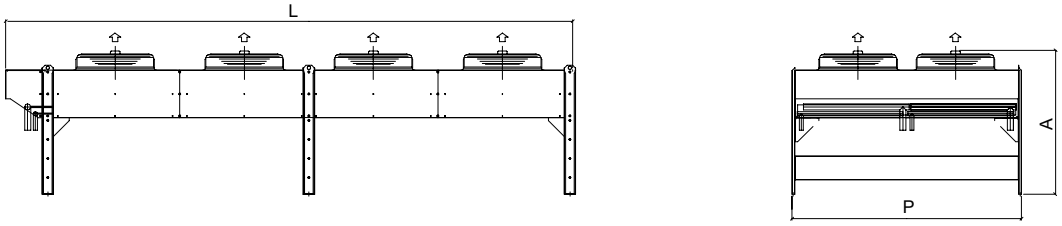
AS Low Noise Version

Models	70.2	80.2	90.2	105.2	120.2	135.2	150.2	170.2	190.2	215.2	240.2	UM
Power supply	400-3+PE-50											V-ph-Hz
Refrigerant	R410A											-
Max working pressure (PS)	45											bar
Coils type	Aluminum fins and copper tubes											-
Gas connections	1x42	1x42	1x42	1x42	1x42	1x42	1x54	1x54	2x42	2x42	2x42	n° x Ø
Liquid connections	1x35	1x35	1x28	1x35	1x35	1x35	1x42	1x42	2x35	2x35	2x35	n° x Ø
Fan specification												
Fan	3	3	2	2	2	3	3	3	4	4	4	n°
Diameter	630	630	800	800	800	800	800	800	800	800	800	mm
Air flow rate	22500	22500	33800	28600	26800	50700	42900	40200	54800	50800	50800	l/s
Power input	0.99	0.99	1.96	1.96	1.96	2.94	2.94	2.94	3.92	3.92	3.92	kW
Current input	2.19	2.19	5	5	5	7.5	7.5	7.5	10	10	10	A
Internal volume	21	21	18	27	35	27	41	53	49	64	64	dm^3
Weight	221	221	279	302	324	413	447	481	502	543	543	kg
Standard configuration Dimension (horizontal air flow)												
Length [L]	3770	3770	3230	3230	3230	4580	4580	4580	3230	3230	3230	mm
height [A]	1230	1230	1370	1370	1370	1370	1370	1370	2390	2390	2390	mm
depth [P]	600	600	800	800	800	800	800	800	800	800	800	mm
Dimension with Configuration with Support Brackets accessories (vertical air flow)												
Length [L]	3770	3770	3230	3230	3230	4580	4580	4580	3230	3230	3230	mm
height [A]	990	990	1565	1565	1565	1565	1565	1565	1565	1565	1565	mm
depth [P]	1230	1230	1370	1370	1370	1370	1370	1370	2390	2390	2390	mm
Noise level												
Sound Power Level	75	75	76	76	76	76	76	76	77	77	77	dB(A)
Sound pressure level at 1mt	58	58	57	57	57	59	59	59	60	60	60	dB(A)
Sound pressure level at 5mt	48	48	47	47	47	49	49	49	50	50	50	dB(A)
Sound pressure level at 10mt	43	43	42	42	42	44	44	44	45	45	45	dB(A)

Standard configuration type 1 (horizontal air flow)



Configuration with Support Brackets accessories Type 3 (vertical air flow)

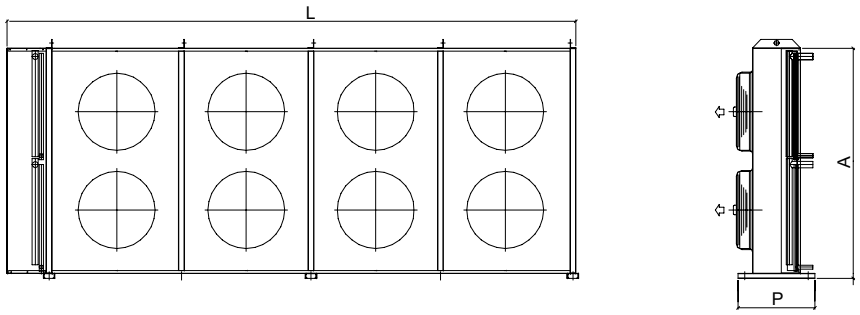


REMOTE AXIAL CONDENSER ACCESSORIES - RC

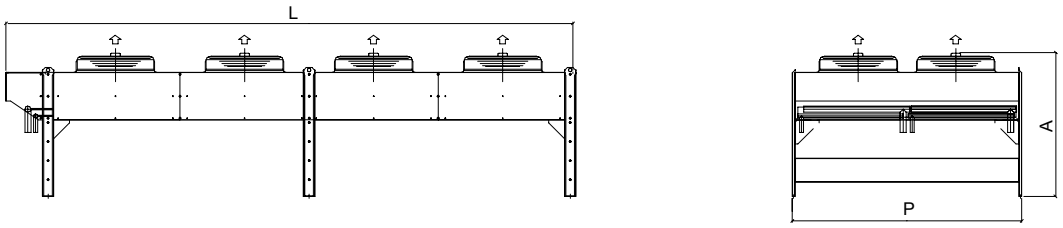
AX Extra Low Noise Version

Models	70.2	80.2	90.2	105.2	120.2	135.2	150.2	170.2	190.2	215.2	240.2	UM
Power supply	400-3+PE-50											V-ph-Hz
Refrigerant	R410A											-
Max working pressure (PS)	45											bar
Coils type	Aluminum fins and copper tubes											-
Gas connections	1x42	1x42	1x42	1x42	1x42	1x54	1x54	2x42	2x42	2x42	2x42	n° x Ø
Liquid connections	1x28	1x28	1x35	1x35	1x35	1x42	1x42	2x35	2x35	2x35	2x35	n° x Ø
Fan specification												
Fan	2	2	2	2	3	3	3	4	4	4	4	n°
Diameter	800	800	800	800	800	800	800	800	800	800	800	mm
Air flow rate	24400	24400	22000	20200	36600	33000	30300	41600	38400	69600	69600	l/s
Power input	1.18	1.18	1.18	1.18	1.77	1.77	1.77	2.36	2.36	2.36	2.36	kW
Current input	2.5	2.5	2.5	2.5	3.75	3.75	3.75	5	5	5	5	A
Internal volume	18	18	27	35	27	41	53	49	64	49	49	dm^3
Weight	279	279	302	324	413	447	481	502	543	680	680	kg
Standard configuration Dimension (horizontal air flow)												
Length [L]	3230	3230	3230	3230	4580	4580	4580	3230	3230	4580	4580	mm
height [A]	1370	1370	1370	1370	1370	1370	1370	2390	2390	2390	2390	mm
depth [P]	800	800	800	800	800	800	800	800	800	800	800	mm
Dimension with Configuration with Support Brackets accessories (vertical air flow)												
Length [L]	3230	3230	3230	3230	4580	4580	4580	3230	3230	4580	4580	mm
height [A]	1565	1565	1565	1565	1565	1565	1565	1565	1565	1565	1565	mm
depth [P]	1370	1370	1370	1370	1370	1370	1370	2390	2390	2390	2390	mm
Noise level												
Sound Power Level	68	68	68	68	70	70	70	71	71	73	73	dB(A)
Sound pressure level at 1mt	51	51	51	51	53	53	53	54	54	56	56	dB(A)
Sound pressure level at 5mt	41	41	41	41	43	43	43	44	44	46	46	dB(A)
Sound pressure level at 10mt	36	36	36	36	38	38	38	39	39	41	41	dB(A)

Standard configuration type 1 (horizontal air flow)



Configuration with Support Brackets accessories Type 3 (vertical air flow)



RECEPTION AND POSITIONING

Inspections on arrival

As soon as the unit is consigned, it is essential to make sure that all the ordered items have been received and that the dispatch is complete. Carefully check that the load has not been damaged. If visible damage is discovered, immediately inform the haulage contractor and write "Collected with reserves owing to evident damage" on the consignment note. Delivery at the plant means that any damages will be reimbursed by the insurance company as established by law.

Safety prescriptions

Comply with the current safety provisions in relation to the equipment used to handle the unit and the ways in which these operations are carried out.

Handling

Before moving the unit, check its weight on the data plate with the general specifications of the appliance and consult the Main Features section of this manual. Make sure that the unit is handled with care, that it is not jolted in any way and that none of its functional parts is damaged.
Comply with the following instructions when lifting and positioning the unit:

• Handling with a lift truck or similar

The unit has four wooden bases so that it can be transported in a longitudinal and sideways direction.
Do not allow the unit or any of its parts to drop on to the ground. Remember that the heaviest part is the one where the compressor is installed (electric panel side Fig.1). Refer to the data plates (Part.3 Fig.1) that identify the center of gravity position, applied to the 4 sides of the base.

Fig. 1

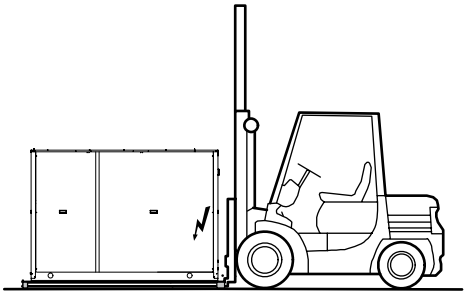


Fig. 2

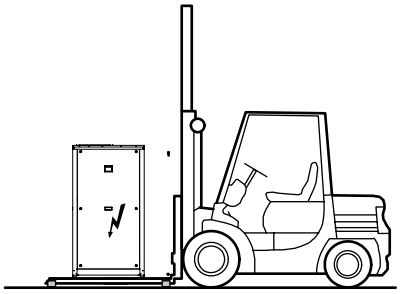
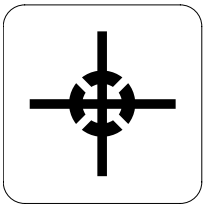
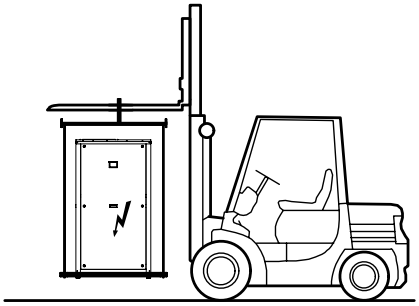


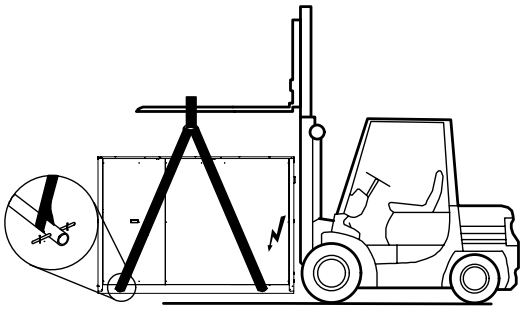
Fig. 3



• Lifting and handling with a crane or similar

• Position metal tubes of an adequate thickness in the holes on the base of the unit in order to lift it.
• The ends of the tubes must project to an adequate extent to allow safety components to be inserted and the lifting belts to be fitted.
• Consult the tables in the section "Dimensional data" when the appliance arrives section for the venter of gravity position.
• Use spacer bars in the top part of the unit to prevent the plastic parts covering the unit from being crushed and damaged.





WARNING:
Before proceeding with the handling operations, read the information on the wrapping to ensure the safety of persons and property. Also be sure to:
• Handle the load with care
• Avoid stacking other objects on top of the unit

Storage

The units must be stored in a dry place sheltered from the run, rain, sand and wind.
The storage conditions are:
• Do not stack the units
• Maximum temperature = 60°C
• Minimum temperature = -10°C
• Humidity = 90%

REFRIGERANT CONNECTIONS

The refrigerant circuits of split systems have to be designed and built considering that:

When the system is stopped the refrigerant try to move to the coldest point of the system

The refrigrerant pipes (usually made of copper) are subject to hign expansions depending on ambient temperature during the year

The pipes pressure drop have to be limited since they reduce cooling capacity and efficiency of the system

The refrigerant velocity has to be superior to a minimum value in order to allow oil return to the compressors both at maximum and minimum capacity

To ensure a correct working of the system and so for reducing costs and environment impact it is preferable to reduce to the minimum the refrigerant charge

Refrigerant migration during standstill periods (compresors stopped)

During standstill periods (with stopped compressors) the refrigerant try to move to the coldest point of the system.
During nighttime or during winter (for systems with condenserless units and remote condenser) the coldest point becomes the condenser (subject to external air temp): so all the refrigerant condenses (becoming liquid) into the coil of remote condenser.
In order to avoid that compressors were flooded by liquid it is necessary to provide shutoff devices (automatic as for instance liquid solenoid valve and manuals as for instance shutoff valves on liquid and discharge pipes) and for specific cases to install a liquid receiver of appropriate volume.

Note: if the system has not to work during wintertime it is preferable shutoff the valves on liquid and discharge pipes.

Refrigerant pipes

The refrigerant lines have to be bulit with pipes (usually copper) with thickness adequate to the maximum working pressure (PS).

In table some technical features of copper refrigerant pipes usually available:

Tab. T1

External diameter	[mm]	10	12	14	16	18	22	28	35	42	54	67	76	89	108
Thickness	[mm]	1	1	1	1	1	1	1	1.5	1.5	2	2	2	2.5	2.5
Weight per 1 meter of line	kg/m	0.25	0.31	0.36	0.42	0.48	0.59	0.76	1.41	1.70	2.92	3.65	4.15	6.07	7.40
R410A charge per 1 meter of LIQUID line	kg/m	0.05	0.07	0.10	0.14	0.18	0.28	0.48	0.72	1.08	1.77	2.81	3.67	4.99	7.51
R410A charge per 1 meter of DISCHARGE line	kg/m	0.005	0.008	0.011	0.015	0.020	0.031	0.052	0.079	0.117	0.193	0.306	0.400	0.544	0.818

Expansion of the pipes and their compensation

Following temperature variations the copper pipes expand.
In table the expansions of pipes related to temperature variation.

Temperature difference	[°C]	0	20	40	60	80	100	120	140
Expansion	[mm/m]	0.0	0.4	0.6	0.9	1.3	1.6	1.9	2.2

For a correct estimation of the maximum working temperature of discharge line it is enough to add 60°C to the maximum condensing temperature reached during working condtions

For instance if the maximum condensing temperature is 60°C, for discharge line the maximum temperature is 120°C: assuming that pipes are installed with external air temp of 20°C you have to consider a temperature variation of 100°C and so provide flexible hoses or U-bends to allow an appropriate expansion.

REFRIGERANT CONNECTIONS

Selection of pipes diameters

The pressure drops arise on liquid and discharge lines.

Liquid Line

The pressure drop on the liquid line cause a neglectable reductions on capacity and efficiency of the system, however they have to be limited to avoid the refrigerant rievaporation that can generate a non correct feed of expansion valve (bubbles on liquid sight glass placed upstream the xpansion valve) so making the system unstable and possible cause of liquid return to the compressors.

Tab. L1

H (Fig. 3)	kPa	ΔT
10	88	1.39
20	177	2.84
30	265	4.32
40	354	5.85

On sizing the liquid line diameter it must take care particularly when remote condenser is placed at a level lower than condenserless unit, since that difference turns on a loss of subcooling (ref. tab. L1).
With R410A is not recommended level difference higher than 20 meters.
The diameter selection is strictly related to cooling capacity to achieve a velocity of 1:1.5 m/s: with thiese velocities the pressure drop of the liquid line are neglectable.
However so reducing the refrigerant charge it's possible to use a minor diameter paying attention to limit the velocity under 1.8:2 m/s 8re, tab. L2).

Tab. L2

diameter x thickness pipe	Cooling capacity [kW]																											v [m/s]
	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240	250	260	270	280	290	300		
22x1	0.9	1.1	1.3	1.5	1.7	1.9	2.1	2.3																				
28x1	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.6	1.7	1.8	1.9	2.0	2.1	2.2												
35x1.5			0.5	0.6	0.7	0.7	0.8	0.9	0.9	1.0	1.1	1.2	1.2	1.3	1.4	1.5	1.5	1.6	1.7	1.8	1.8	1.9	2.0	2.1	2.1	2.2		
42x1.5								0.5	0.6	0.6	0.7	0.8	0.8	0.9	0.9	1.0	1.0	1.1	1.1	1.2	1.2	1.3	1.3	1.4	1.4	1.5		

Discharge line Δp *[kPa for 1 meter of pipe]*

The pressure drop on discharge line leads to an increase of compressor condensing pressure with a reduction of capacity and an increase of power input.
The pressure drop is expressed in kPa but usually it is converted in an increase of condensing saturation temperature and so expressed as a *Δ*T (ref tab. M1 and M2).
Moreover you have to consider the concntrted pressure drop due to bends, TEE, siphons or other components (mufflers, oil separtor, shutoff valves, etc.)
Respect to commercial componets refer to features declared by the manufacturer, instead referring the fitiings use table R1 to calculate the equivalent length.

Tab. M1

diameter x thickness pipe	Cooling capacity [kW]																											Δp [kPa per 1 metro di linea]
	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240	250	260	270	280	290	300		
22x1	2.7	3.9	5.3	6.9	8.7	10.1	12.2	14.5	17.1	19.8	22.2																	
28x1	0.7	1	1.4	1.8	2.3	2.7	3.3	3.9	4.6	5.3	5.9	6.7	7.6	8.5	9.5	10.2	11.2	12.3	13.5	14.7	15.8	17.1	18.4	19.8	21.3	22.6		
35x1.5		0.4	0.6	0.8	1	1	1.2	1.4	1.7	2	2.1	2.4	2.7	3	3.4	3.6	4	4.4	4.8	5.2	5.5	5.9	6.4	6.9	7.4	7.9		
42x1.5					0.3	0.4	0.5	0.6	0.7	0.8	0.8	0.9	1	1.2	1.3	1.3	1.4	1.6	1.7	1.9	2	2.2	2.3	2.5	2.7	2.9		
54x1.5											0.1	0.1	0.1	0.1	0.2	0.4	0.4	0.5	0.5	0.6	0.5	0.5	0.6	0.6	0.7	0.8		

Tab. M2

diameter x thickness pipe	Cooling capacity [kW]																											Δt [°C per 1 metro di linea]
	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240	250	260	270	280	290	300		
22x1	0.04	0.06	0.07	0.1	0.12	0.15	0.18	0.21	0.25	0.28	0.32																	
28x1	0.01	0.01	0.02	0.03	0.03	0.04	0.05	0.06	0.06	0.07	0.08	0.1	0.11	0.12	0.14	0.15	0.16	0.18	0.19	0.21	0.23	0.25	0.27	0.29	0.31	0.33		
35x1.5		0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.03	0.03	0.03	0.04	0.04	0.05	0.05	0.06	0.06	0.07	0.07	0.08	0.09	0.09	0.1	0.11	0.11		
42x1.5					0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.03	0.04	0.04	0.04		
54x1.5											0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01		

REFRIGERANT CONNECTIONS

Tab. M3

ΔT	Δ cooling capacity [%]	Δ CP power input [%]
0	1	1
0.5	0.993	1.010
1	0.985	1.02
1.5	0.978	1.030
2	0.97	1.04
2.5	0.963	1.050
3	0.955	1.06
3.5	0.948	1.070
4	0.94	1.08

In table M3 you find the correction factors for capacity and compressors power input as a function of total pressure drop of the discharge line expressed (*Δ*T) in °C.

Oil return to the compressors

During standard working of the refrigerant compressors a little amount of oil mixes with the refrigerant gas so circulating into the system.

The oil , not still mixed with the refrigerant, reaches the condenser where is dissolved completely into the liquid and so returnig to the unit compressors.

The oil return can be achieved for gravity or drag.

The problem does not arise if the condenser is installed at same (Fig.1) or lower level (fig. 2-3) than condenserless unit, instead if installed at higher level (Fig.4) it is necessary sizing the discharge line so ensuring (particularly when the unit has to work at partial capacity) a minimum refrigerant velocity to achieve the oil drag.

To guarantee an effective oil return it is recommended to size the diameter to have a velocity (with unit at full capacity) of minimum 4m/s for the horizontal lines and 8m/s for the vertical lines.

For very long vertical lines you have to provide some siphons.

For horizontal lines it is however suggested to install the discharge pipe with an adequate slope (2:3%) towards the condenser.

Tab. M4

diameter x thickness pipe	Cooling capacity [kW]																										v [m/s]
	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240	250	260	270	280	290	300	
22x1	9.2	11	12.9	14.7	16.6	18.4	20.2	22.1	23.9	25.8	27.6																
28x1	5.5	6.6	7.7	8.8	9.9	10.9	12	13.1	14.2	15.3	16.4	17.5	18.6	19.7	20.8	21.8	22.9	24	25.1	26.2	27.3						
35x1.5	3.6	4.3	5	5.8	6.5	7.2	7.9	8.6	9.4	10.1	10.8	11.5	12.2	13	13.7	14.4	15.1	15.8	16.6	17.3	18	18.7	19.4	20.2	20.9	21.6	
42x1.5	2.4	2.9	3.4	3.8	4.3	4.8	5.3	5.8	6.2	6.7	7.3	7.8	8.3	8.8	9.2	9.7	10.2	10.7	11.2	11.6	12.1	12.6	13.1	13.6	14	14.5	
54x1.5											4.3	4.6	4.9	5.2	5.4	5.7	6	6.3	6.6	6.8	7	7.3	7.6	7.8	8.1	8.5	

Tab. R1

factors for calculation of the equivalent length

d ext [mm]	12	16	18	22	28	35	42	54	67
bend 90° standard	0.4	0.48	0.5	0.6	0.8	1	1.2	1.5	1.7
bend 90° wide radius	0.3	0.3	0.3	0.4	0.5	0.7	0.8	1	1.2
elbow a 90°	0.7	0.76	0.8	1	1.2	1.7	1.9	2.5	2.9
bend a 45°	0.2	0.24	0.28	0.3	0.4	0.5	0.6	0.8	0.97
elbow a 45°	0.3	0.4	0.4	0.5	0.6	0.9	1	1.4	1.6
bend a 180°	0.7	0.76	0.8	1	1.2	1.7	1.9	2.5	2.9
siphon	2.8	3	3.2	4	4.8	6.8	7.6	10	11.6
TEE	0.3	0.3	0.3	0.4	0.5	0.7	0.8	1	1.2
TEE with reduction	0.4	0.48	0.5	0.6	0.8	1	1.2	1.5	1.8

REFRIGERANT CONNECTIONS

Fig. 1

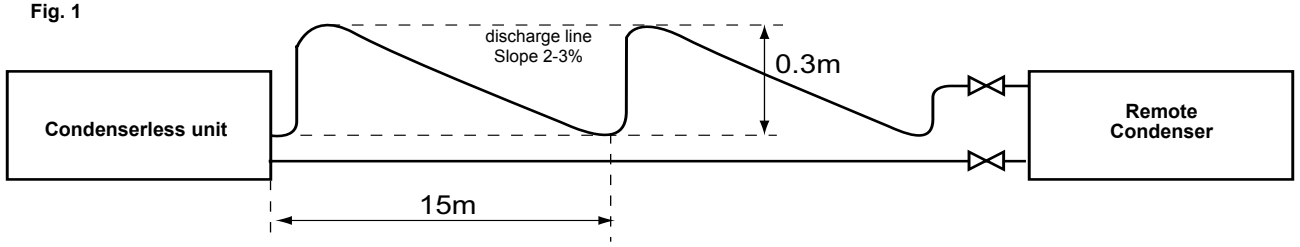


Fig. 2

BOTTOM LEVEL

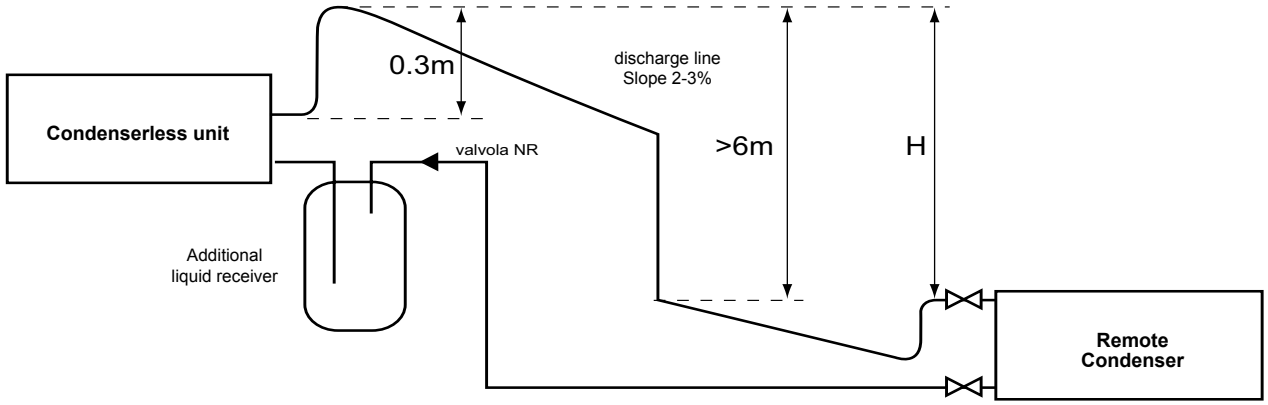


Fig. 3

BOTTOM LEVEL

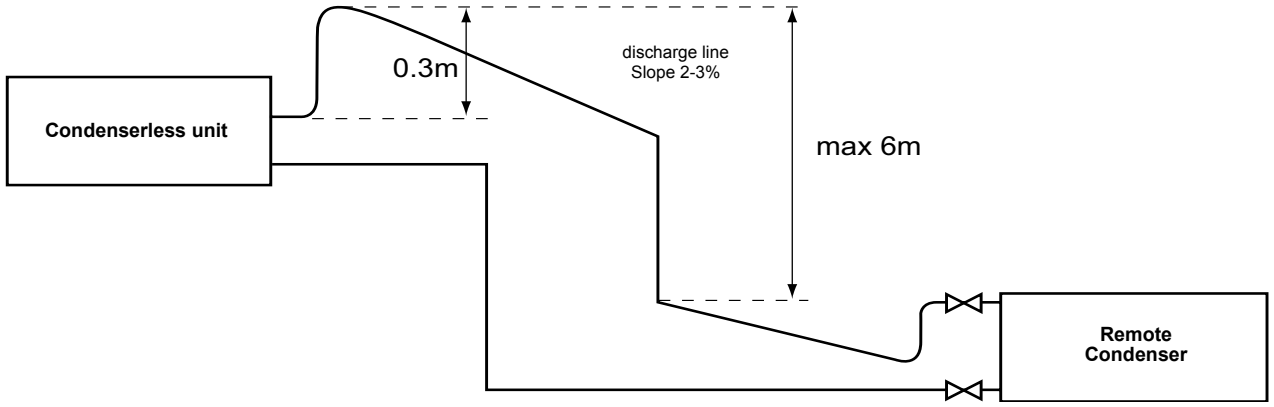
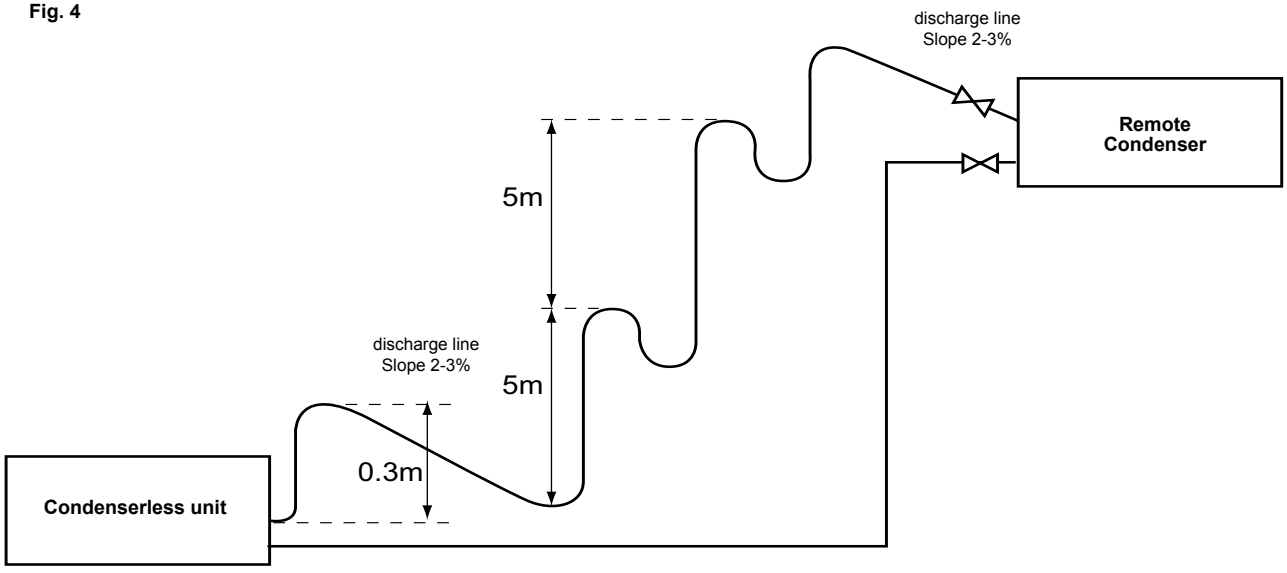


Fig. 4



Exanple of calculation

It is assumed that it has been selected a condenserless unit mod. IR 105.2 VB AB 0R5 abd the remote condenser has to be installed higher than the unit with a drop of 12 meters (re, Fig.4).
Moreover there are 2 horizontal lines of 11 and 8 meters.
In nominal conditions in the section ….. you extract:
Ccoling capacity = 92 kW
Compressors power input = 29,3 kW

Liquid Line

From tab. L2 with a capacity of 92 kW we can choice between a diametr of 28x1 (interpolating the velocity calculated is 1.02m/s) and a diameter of 22x1 (interpolating the velocity calculated is 1.74m/s)
From tab. T1 we extract:
d 22x1 weight of pipe = 0.59 kg/m R410A charge = 0,28 kg/m
d 28x1 weight of pipe = 0.76 kg/m R410A charge = 0,48 kg/m
We select diameter 22x1 that allows a velocity lower tha the admissible limit (< 2m/s) and moreover a saving of 22% in weight and 42% on r410A charge.

Discharge Line

Since there is a climb vertical line with that cooling capacity it is recommended a diameter 28x1.
In fact from tab.M3 interpolating between 90 and 100 kW we extract a velocity of 10.2 m/s (>8m/s)
From tab. M1 we extract a pressure drop of 2.3 kPa per meter and from tab. M2 a DT of 0.032°C per meter.
Considering 2 syphons for the vertical line, 4 standard 90° bends and 2 U-bends (for compensating of thermal expansions for the 2 horizontal lines).
From tab. R1 we extract the correction factors:

standard 90° bend	0.8
U bend	1.2
Syphon	4.8

Equivalent length = 11 + 12 + 8 + 4 x 0.8 + 2 x 1.2 + 2 x 4.8 = 46.2 m

Pressure drop of discharge line	= 2.3 x 46.2	= 106.3 kPa
	= 0.032 x 46.2	= 1.48°C

From tab. M4 interpolating we achieve the following correction factors:

for cooling capacity CCPF	= 0.985
for compresors power input	= 1.02

Therefore with tis type of installation the actual capacity and power input are:

Cooling capacity	= 0.985 x 92	= 90.6 kW
Compressors power Input	= 1.02 x 29.3	= 29.9 kW

R410A charge for the lines (for simplicity in the estimation of refrigerant charge it has been considere the length of straight lines only.

Discharge (d 28x1)	= (11 + 12 + 8) x 0.052	= 1.6 kg
Liquid (d 22x1)	= (11 + 12 + 8) x 0.28	= 8.7 kg

REFRIGERANT CONNECTIONS

Installation Procedure

The discharge and liquid pipe connections are identified by a label on the frame if the unit and are supplied cith female connection plugged with a plastic plug.
The unit is equipped with the 2 ball valves (liquid and discharge) CLOSED: this allows to maintain the refrigerant circuit part including the compressors, heat exchanger, filter, expansion vale, ecc. Gharged with NITROGEN (p=1bar) and so to avoid entrance of air and moisture.
Note: the ball valves, if open, lead to the leak of nitrogen with risk of air entrance.

For making the connection between condenserless unit and remote condenser proceed as following descrive:

1) Install the refrigerant pipes from the remote condenser toward the condenserless unit
2) Braze the pipe to the discharge connection of the unit
3) Arrange in advance the liquid connection in order to reduce to minimum the time necessary to the following brazing
4) Connect the vacuum pump to the provided points: in the condenserless unit some pressure taps (1/4" SAE and 5/15" SAE) with needle are available ref. to refrigerant diagram.
5) Open the liquid ball valve discharging the nitrogen of the condenserless unit
6) In the shortest possible time (max 15 minutes) make the brazing of the liquid pipe
7) Switch on the vacuum pump
8) Open the discharge ball valve
9) Switch off the vacuum pump
11) Check the tightness of the system
12) Charge with refrigerant gas

Estimation of the refrigerant charge

Roughly it is necessary the amount of refrigerant indicated in tab.C1 and to add the amount calculated for the lines, moreover it is necessary a back-up amount of another 20% (at least).

For instance for mod. 105.2 with reference to the calculation example:

MODELS	70.2	80.2	90.2	105.2	120.2	135.2	150.2	170.2	190.2	215.2	240.2	UM
Estimated charge	13.7	15.3	18.2	20.7	23.2	26.1	29.3	33.5	37.8	42.8	47.3	kg

from tab. C1	unit charge	= 20.7 kg
	discharge line	= 1.6 kg
	liquid line	= 8.7 kg
	TOT estimated	**= 31 kg**

When you are ready to charge it is necessary another 20% of refrigerant gas at least, so the total amount necessary is = 1.2 x 31 = 37 kg R410A

For condenserless unit with thermostatic expansion valve:
Charge with 31 kg
Start-up the system
Adjust the opening of thermostatic valve and the refrigerant charge in order to achieve a subcooling and a superheat of 5K (±1K).

For condenserless unit with electronic expansion valve:
Charge with 31 kg
Start-up the system
Adjust the refrigerant charge in order to achieve a subcooling of 5K (±1K).

HYDRAULIC CONNECTIONS

General rules

A mesh filter (hole Ø £ 500 µm) must be installed on the unit's water inlet otherwise warranty is immediately forfeited for units with either the standard or the complete pipe kit and MP-PS. The filter performs the function of blocking any foreign matter in the system's plumbing circuit (shavings, machining debris, etc.). This prevents the plate exchanger water pipes from clogging then possibly freezing (and therefore bursting). This filter is included in the unit equipped with the hydronic kit accessory.

Comply with the local laws governing safety matters in order to correctly design the hydraulic circuit. The following information gives suggestions on how to correctly install the unit.
1) Standard supply.
• The unit comes as standard with a differential pressure switch located between the entrance and exit of water plant exchanger and for IP and BP units another one for the source water exchanger to prevent freezing problems in case of lack of water flow.
The intervention is calibrated to a DP of 80 ± 5 mbar, while the reset occurs with a DP of 105 ± 5 mbar.
The differential pressure switch contact opens and stop the unit when you reduce the water flow and so DP ≤ 80 mbar ± 5.
The differential pressure switch closes and then the unit can restart when the water flow increases and so Dp ≥ 105 mbar ± 5.
2) With hydronic kit accessory.
• Besides the standard accessories, the unit is equipped with all the hydraulic components, as specified in the "Options and accessories" section.

Hydraulic layout of the system

General suggestions
• The pipes must have the least possible number of bends to minimize load losses and must be adequately supported in order to prevent the connections of the unit from being excessively stressed.
• Install on-off valves near components that need to be serviced to isolate them when maintenance work needs to be done and to allow them to be replaced without having to discharge the system.
• Before isolating the pipes and charging the system, carry out preliminary inspections to make sure that there are no leaks.
• Isolate all the chilled water pipes to prevent condensation from forming along the pipes themselves. Make sure that the material used is the steam barrier type, failing this, cover the insulation with an appropriate protection. Also make sure that the air venting valves can be accessed through the insulation.
• Do not forget to install or at least allow for the installation of pressure and temperature reading instruments on the inlet and outlet parts of the hydraulic circuit. These instruments will allow you to monitor the operation of the system.
• The circuit can be kept under pressure by means of an expansion tank (with which the unit is equipped if the hydronic kit accessory is installed) and a pressure reducer. A plant filling unit can also be used in order to automatically charge the system and keep it at the desired pressure if it drops below a certain pressure value. Install manual or automatic values in the highest point of the system to eliminate air from the circuit.
Fit manual or automatic valves at the highest point in the circuit in order to vent air from the circuit.
• Depending on the chosen accessory, there may be Victaulic-type joints for hooking up to the unit. The joints allow the pipes to expand due to changes in temperature and in addition the elastomer gasket and the specified play help insulate and absorb noise and vibration.
• If anti-vibration mounts are installed under the unit, it is recommended to use flexible couplings before and after the water circulation pump and near the unit.
• Install a cock on the outlet of the unit in order to regulate the water flow.

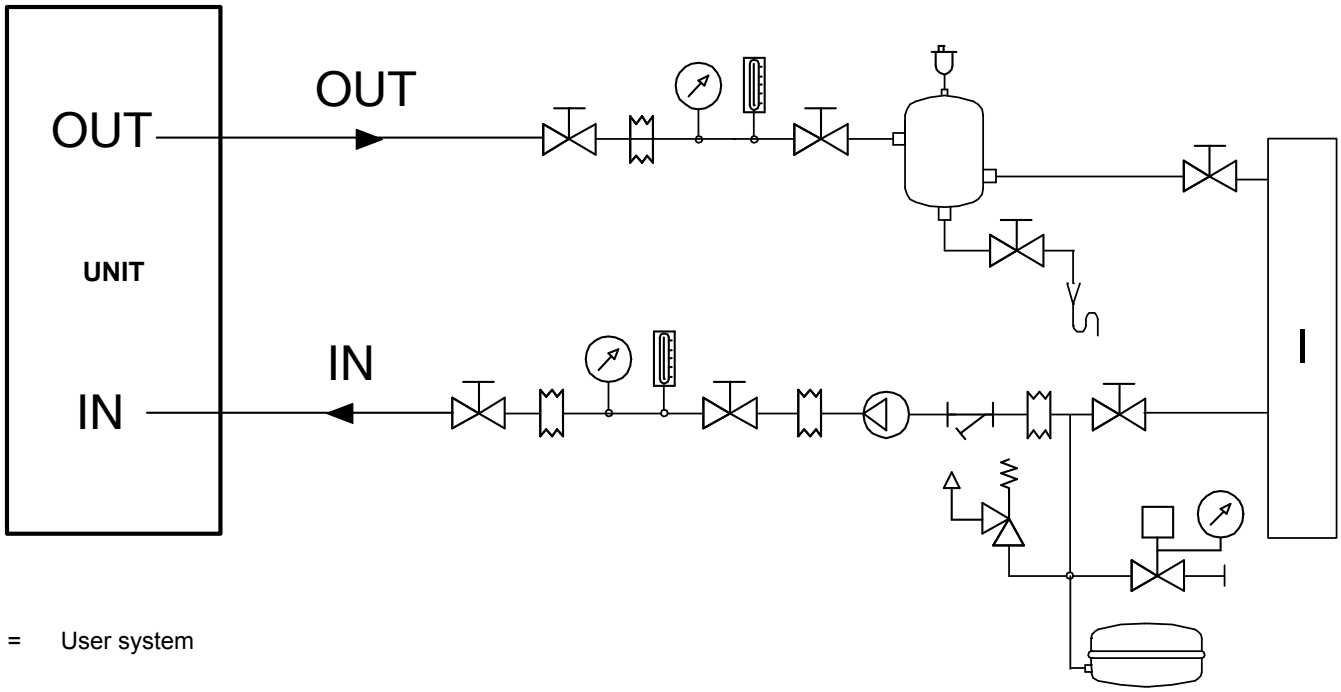
Precautions for the Winter

The water could freeze and damage the exchanger of the unit and other parts of the system during the winter period, if the system was to remain at a standstill. This problem can be obviated in 3 different ways:
1. Drain the system completely, taking care to drain the plate exchangers (in order to drain the unit's plumbing system completely, open the water drain ball valves and the air vent valves) and centrifugal pumps.
2. Operate with glycol water taking account, depending on the % of glycol, of the factor of correction of the refrigerating capacity, power input, water flow rate and losses of head (see the "Correction factor for the use of glycol" section).
3. If it is certain that the unit will always be powered throughout the winter, the unit is able to protect itself from freezing, down to a temperature of -20°C: this is possible thanks to the low temperature kit (accessory) composed by 2 antifreeze heaters installed on the water exchangers and to a intelligent control of the water pumps that must be governed by the microprocessor board (see the “Electric Connections” section).

HYDRAULIC CONNECTIONS

Basic diagram Basic Version VB [USER SYSTEM SIDE]

The following figures represent connections to the evaporator circuit.
IMPORTANT: There must be a constant flow of water to the exchanger .



I = User system

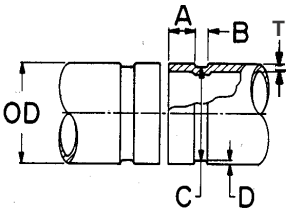
- Pressure gauge
- Thermometer
- On-off and/or water flow rate regulating valve
- Monitoring electronics (governor)
- Pump
- Filter
- Tank
- Expansion tank
- Air vent valve
- Safety valve
- Coupling
- Water filling unit
- Three-way driven valve
- Recovery water flow inlet probe

HYDRAULIC CONNECTIONS

ISO-G	DN(mm)	EXTERNAL DIAMETER OD(mm)	A	B	O	D	T
1”	25	33.7	15.875	7.137	30.226	1.600	1.651
11/4”	32	42.4	15.875	7.137	38.989	1.600	1.651
11/2”	40	48.3	15.875	7.137	45.085	1.600	1.651
2”	50	60.3	15.875	8.738	57.150	1.600	1.651
21/2”	65	76.1	15.875	8.738	72.260	1.981	2.108
3”	80	88.9	15.875	8.738	84.938	1.981	2.108
4”	100	114.3	15.875	8.738	110.084	2.108	2.108
5”	125	139.7	15.875	8.738	135.500	2.134	2.769
6”	150	168.3	15.875	8.738	163.957	2.159	2.769
8”	200	219.1	19.050	11.913	214.401	2.337	2.769

1) Pipe groove inspections

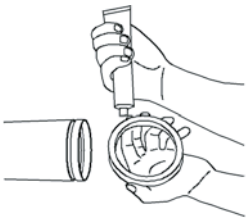
Check the depth and diameter of the grooves and their distance from the pipe ends. Make sure that the work has been carried out with care and that the end surface of the pipes is smooth and not ovalized. Make sure that there are no notches, burrs or other imperfections that could impair the tightness. Groove dimensions in mm A=16-B=8-C=57.2-D=1.6



2) Checking the seal and relative lubrication

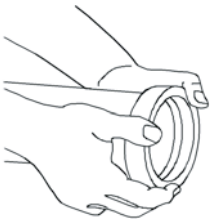
Make sure that the type of seal used is compatible with the nature and temperature of the fluid. Signal green **EPDM** seals are used.

Apply a film of grease to the seal: on the back, on the side flanks and on the inner lips that contact the pipe. Work in conditions of the utmost cleanliness as particles of dirt could damage the seal. Always and only use synthetic grease. Greasing makes it easier to fit the seal on the pipe and improves the tightness. It also allows the seal to slide within the connection, avoiding tensions and projections near the bolts.



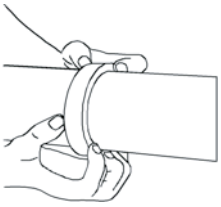
3) How to fit the seal

Fully insert the seal into the end of a pipe. Make sure that the seal lips adhere to the pipe itself.



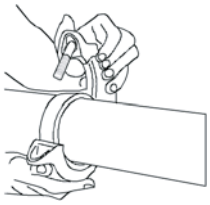
4) Alignment

Align the pipes and move their ends near to each other. Now push the seal, centering it on the two pipe ends. The seal must remain inside the grooves.



5) Joint assembly

Remove one bolt and loosen (without removing) the other one. Seat part of the body of the joint at the bottom, between the pipe ends, inserting and edges of the grooves. Now seat the other part of the body at the top, on the two ends, and close the joint. Make sure that the parts of the body of the joint touch each other.

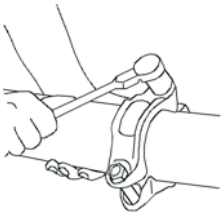


6) Nut torquing

Fit the previously removed bolt back in place and tighten both nuts by hand. Now torque them with the relative wrench, tightening them alternately a few turns.

WARNING:

If one nut is fully tightened at a time, the seal could slip between the jaws of the opposite side of the joint.



ELECTRICAL CONNECTIONS

General rules

The appliance must be wired in compliance with the laws in force in the country in which it is installed. The units are supplied fully wired in the factory and pre-engineered for connection to the electricity main. The electric panel is made in compliance with the technical standards in force in the European Union.

Structure of the electric panel

All the electrical components are contained in a closed casing protected against the atmospheric agents and inspectionable by opening the front door after removing the front panel (if present). The door for accessing the power section is locked by the mechanism. Access for the supply cables and earth cable (PE) is permitted through the opening on the botton of the electric panel.

Composition of the system

The system comprises an electromechanical part consisting of the power circuit, with disconnecting device, contactors, fuses or thermal cutouts, transformer, and another part comprising the Microprocessor control system.

NOTES: Refer to the wiring diagram supplied with the unit for the layout of the electric panel.

Electrical connections

All electrical connections must be carried out by qualified personnel in the absence of electric power. The table below gives the electrical specifications of the different constructional configurations of the units.

Standard unit

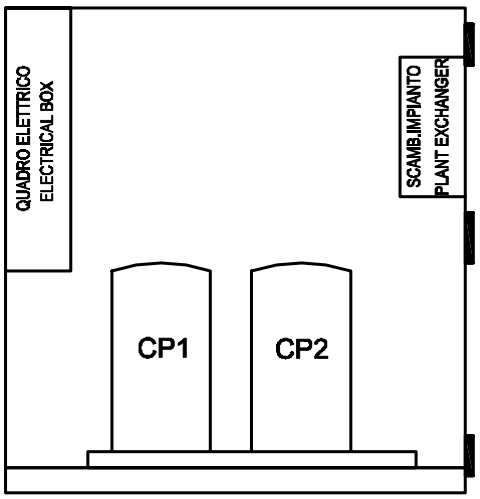
UNIT	70.2	80.2	90.2	105.2	120.2	135.2	150.2	170.2	190.2	215.2	240.2	UM
Power supply	400 - 3 - 50											V-ph-Hz
TOTAL FLA	45	51	62	68	74	82	90	105	120	142	164	A
TOTAL FLI	26	29	34	40	45	50	55	63	72	83	93	kW
TOTAL MIC	141	166	204	256	262	309	317	355	370	454	476	A

NOTES:
Values relative to a 400V-3-50Hz power supply voltage rating
FLA= Power draw at maximum tolerated conditions
LRA= Locked Rotor Amps
FLI= Electric power draw at maximum tolerated conditions
MIC= Maximum surge current of the unit

Compressor specification

UNIT		70.2	80.2	90.2	105.2	120.2	135.2	150.2	170.2	190.2	215.2	240.2	UM
Power supply		400 - 3 - 50											V-ph-Hz
FLA	CP 1	22.6	25.6	31.0	31.0	37.0	37.0	45.0	45.0	60.0	60.0	82.0	A
	CP 2	22.6	25.6	31.0	37.0	37.0	45.0	45.0	60.0	60.0	82.0	82.0	
FLI	CP 1	13.2	14.7	17.0	17.0	22.6	22.6	27.3	27.3	36.1	36.1	46.7	kW
	CP 2	13.2	14.7	17.0	22.6	22.6	27.3	27.3	36.1	36.1	46.7	46.7	
LRA	CP 1	118	140	173	173	225	225	272	272	310	310	394	A
	CP 2	118	140	173	225	225	272	272	310	310	394	394	

Unit layout



ELECTRICAL CONNECTIONS

1) Connection to the electricity main

• Power supply line;
The machine's power supply line must be laid by following a clearly defined route in order to make it as correct as possible any without any breaks. Pass the line through the opening on the button of the electrical panel. Secure the line integral with the structure of the machine. Then continue inside the panel and connect the conductors directly to the input terminals of the main disconnecting device of the machine.
• Power supply system;
The power cables of the machine's supply line must be taken from a system of symmetrical three-phase voltages and of a separate protection conductor.

V= 400V ± 10%
f= 50 Hz

• Protection on supply side:
An automatic switch must be installed on the supply side of the side in order to protect against any overcurrents and indirect contacts that could occur when the machine is operating.
It is advisable to install an automatic current limiter switch in order to limit the effective short-circuit current in the connecting point of the machine. This allows a protection device with a lower breaking capacity than that required in the connection point to be sized like the main circuit-breaker of the machine.
The line and switch must be coordinated in compliance with the current laws governing electrical safety matters, regarding the type of installation and environmental conditions in which the machine must operate.
• Protection conductor (ground wire):
The protection conductor from the feeder line must be connected straight to the ground screw identified by code **"PE",** which ensures the equipotential connection of all metal grounding points and structural parts of the machine.

2) Electric panel

• Protection degree:
The electric panel casing is made from sheet metal and has IP22 protection rating at the doors directly accessible from the outside. The other parts of the casing guarantee a protection degree that is at least equivalent to **IP22**, as established by the current laws in force: this has been achieved since the panel has further protection against the penetration of solid foreign bodies and atmospheric agents thanks to the machine structure in which it is housed. If the unit is equipped with panels the protection degree for the electrical panel becomes IP54.
• Starting and stopping function:
The red handle on the panel door directly acts on the main circuit-breaker. The handle also acts as a door lock since it ensures that the machine is only powered when the door is shut. The stopping function carried out by the main circuit-breaker is classified as type "0" since the machine is stopped by immediately cutting off the power supply.

3) Reference standards

• The provisions established by the following Directives have been complied with to ensure the safety of the electrical products placed on the European Union market:
- Low Voltage Directive **2006/95 EEC** which also includes the following harmonized standards:
CEI EN 60335-1 and 60335-2-40.
Classification:**CEI EN 60204-1.** Safety of machinery. Electrical equipment of machines. Part 1: General rules.
- Directive **2004/108/EEC** concerning **"Electromagnetic compatibility".**

4) User connection
In the electrical board are available on terminals:
a) command for water circulation pump (available one relè free contact) and relative thermal protection
b) digital input for remote ON/Stand by of the unit
c) free voltage contact for general alarm (NO)
d) command for remote condenser fans (available one relè free contact) and relative thermal protection

For more details refer to the wiring diagram of the unit.

R410A PROTECTION DEVICES

Protection devices HIGH PRESSURE

The unit is protected against risk of overpressure by means of 3 levels protection chain.

Each circuit is equipped with:
1) high pressure automatic switch connected to electronic controller
2) high pressure manual switch connected to compressor contactor command and to electronic controller
3) high pressure safety valve

Protection devices technical data

LEVEL	1	2	3
Device	High pressure automatic switch	High pressure manual switch	High pressure safety valve
Trip out (barg)	41.0	43.0	45.0
Trip in (barg)	29.5	31.0	41.0
connected to	electronic controller	compressor contactor command	discharge pipe compressor
effect	stop the compressors	stop the compressors	Discharge the refrigerant to atmosphere to reduce the system pressure
reset *	By keyboard if the high pressure switch has trip-in and after the solution of the problem that generates the alarm	Press the button present on the manual pressure switch **CAUTION**	Not necessary

CAUTION

IN CASE OF COMPRESSORS TRIP-OUT BY MANUAL RESET HIGH PRESSURE SWITCH THERE ARE NO EVIDENCES ON THE DISPLAY, DO NOT RESET THE PRESSURE SWITCH BEFORE YOU HAVE DONE THE FOLLOWING STEPS:
1) SHUT DOWN THE UNIT
2) THEN RESET THE HIGH PRESSURE SWITCH

*: For more details refers to section monitoring basic system.

Protection devices LOW PRESSURE

LEVEL	1
Device	Low pressure automatic switch
Trip out (barg)	4 bar Standard Version IR 2 bar Brine Version BR
Trip in (barg)	6 bar Versione Standard IR 4 bar Versione Brine BR
connected to	electronic controller
effect	stop the compressors and pumps of the source side exchanger (if manager by the unit controller)
reset*	YES by keyboard if the low pressure switch has trip-in and after the solution of the problem that generates the alarm

Protection devices DISCHARGE TEMPERATURE (if installed)

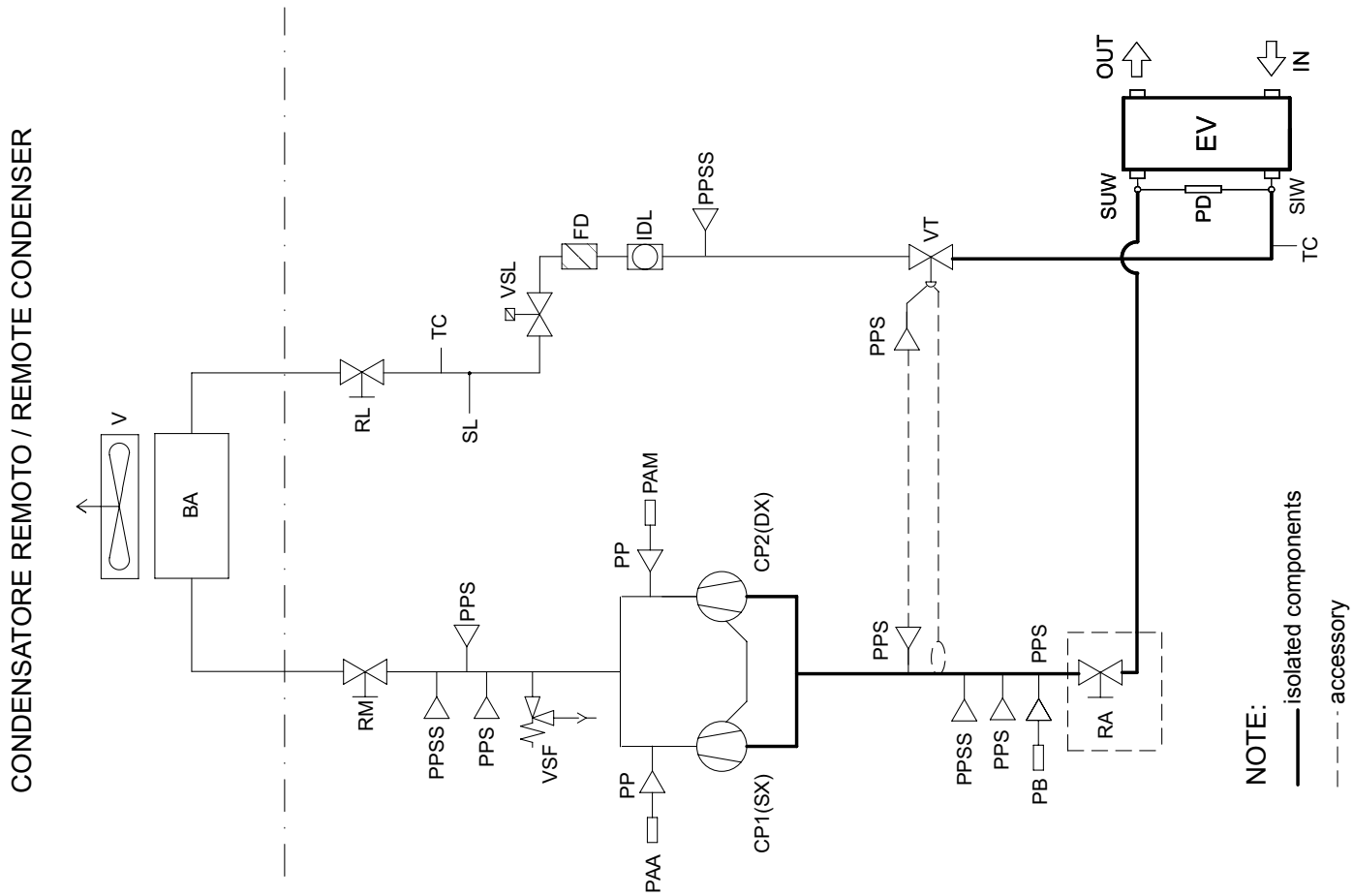
LEVEL	1
Device	High Temperature Thermostat
Trip out	135°C
Trip in	120°C
connected to	electronic controller
effect	stop the single compressor.
reset*	YES by keyboard after the solution of the problem that generates the alarm

*: For more details refers to section monitoring basic system.

REFRIGERANT FLOW DIAGRAM - STANDARD UNIT VB

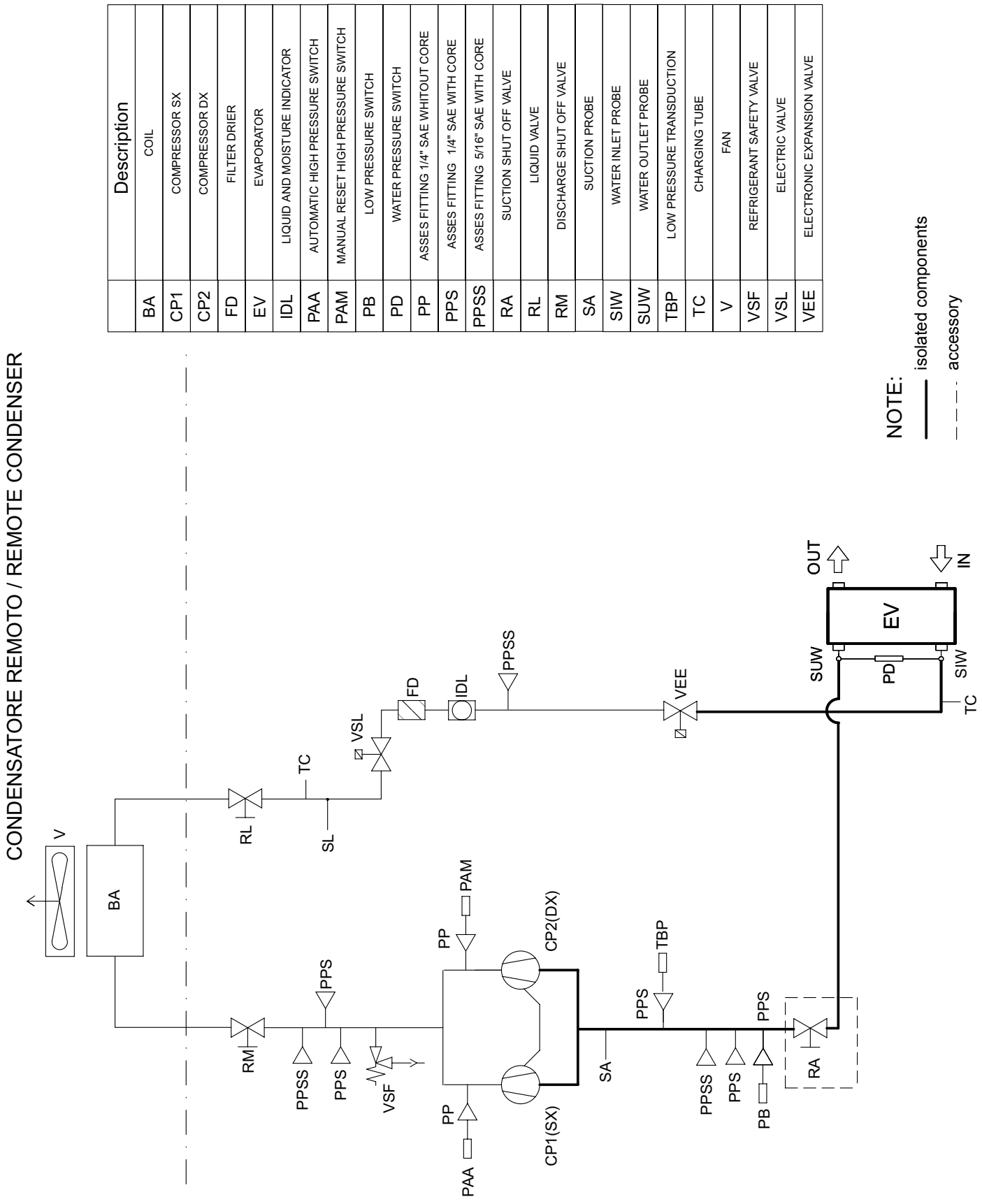
Refrigerant flow diagram in cooling mode IR / BR

	Description
BA	COIL
CP1	COMPRESSOR SX
CP2	COMPRESSOR DX
FD	FILTER DRIER
EV	EVAPORATOR
IDL	LIQUID AND MOISTURE INDICATOR
PAA	AUTOMATIC HIGH PRESSURE SWITCH
PAM	MANUAL RESET HIGH PRESSURE SWITCH
PB	LOW PRESSURE SWITCH
PD	WATER PRESSURE SWITCH
PP	ASSES FITTING 1/4" SAE WHITOUT CORE
PPS	ASSES FITTING 1/4" SAE WITH CORE
PPSS	ASSES FITTING 5/16" SAE WITH CORE
RA	SUCTION SHUT OFF VALVE
RL	LIQUID VALVE
RM	DISCHARGE SHUT OFF VALVE
SIW	WATER INLET PROBE
SUW	WATER OUTLET PROBE
TC	CHARGING TUBE
V	FAN
VSF	REFRIGERANT SAFETY VALVE
VSL	ELECTRIC VALVE
VT	EXPANSION VALVE



REFRIGERANT FLOW DIAGRAM - STANDARD UNIT VB

Refrigerant flow diagram in cooling mode IR / BR with electronic valve



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PPSS	ASSES FITTING 5/16" SAE WITH CORE
RA	SUCTION SHUT OFF VALVE
RL	LIQUID VALVE
RM	DISCHARGE SHUT OFF VALVE
SA	SUCTION PROBE
SIW	WATER INLET PROBE
SUW	WATER OUTLET PROBE
TBP	LOW PRESSURE TRANSDUCTION
TC	CHARGING TUBE
V	FAN
VSF	REFRIGERANT SAFETY VALVE
VSL	ELECTRIC VALVE
VEE	ELECTRONIC EXPANSION VALVE

START-UP

General Rules

To validate the contractual warranty, the machine must be set at work by technicians from an authorized assistance center. Before they are called, check to make sure that all parts of the installation have been completed, the unit levelled, the wet connections made with the relative air vent and the electrical connections made.

MAINTENANCE

General Rules

Maintenance is of extreme importance if the plant is to operate in a regular way and give fade-free service. Have extraordinary maintenance work done by qualified and authorized personnel. Comply with the safety precautions given in the relative section of this manual and take all the necessary precautions.
The following information is only a guide for the end user.

Routine maintenance

The inspections described below, to which the unit must be subjected, do not require specific technical know-how.
They merely include a few simple inspections involving certain parts of the unit.
Call an authorized assistance center if actual maintenance work is required.
The table below gives a recommended list of inspections which should be carried out at the indicated intervals.

DESCRIPTION	WEEKLY	MONTHLY	EVERY SIX MONTHS
Visual inspection of the unit			•
Inspection of hydraulic circuit		•	
Inspection of electrical system		•	
Inspection of condensing system		•	
Inspection and adjustment of operat. parameters	•		

• Visual inspection of the structure of the unit
When checking the condition of the parts that form the structure of the unit, pay particular attention to the parts liable to rust.
If traces of rust are noted, they must be treated with rust-inhibitor paint in order to eliminate or reduce the problem.
Check to make sure that the external panels of the unit are well fixed.
Bad fixing gives rise to noise and abnormal vibrations.
• Inspection of hydraulic circuit
Check visually to make sure that there are no leaks in the hydraulic circuit. If the pumping module accessory is installed, it is advisable to make sure that the water filter is clean.
• Inspection of electrical system
Make sure that the power cable that connects the unit to the distribution panel is not torn, cracked or damaged in a way that could impair its insulation.

MAINTENANCE

General considerations

The machine has been designed with a view to reducing the risks to persons and the environment in which it is installed, to the minimum. To eliminate residue hazards, it is therefore advisable to become as familiar as possible with the machine in order to avoid accidents that could cause injuries to persons and/or damage to property.

a. Access to the unit

Only qualified persons who are familiar with this type of machine and who are equipped with the necessary safety protections (footwear, gloves, helmet, etc.) may be allowed to access the machine. Moreover, in order to operate, these persons must have been authorized by the owner of the machine and be recognized by the actual Manufacturer.

b. Elements of risk

The machine has been designed and built so as not to create any condition of risk. However, residue hazards are impossible to eliminate during the planning phase and are therefore listed in the following table along with the instructions about how to neutralize them.

Part in question	Residue hazard	Mode	Precautions
Compressor and delivery pipe	Burns	Contact with the pipes and/or compressor	Avoid contact by wearing protective gloves
Delivery pipes, plant and source exchanger	Explosion	Excessive pressure	Turn off the machine, check the high pressure switch and safety valve and the water pumps
Pipes in general	Ice burns	Leaking refrigerant	Do not pull on the pipes
Electrical cables, metal parts	Electrocution, serious burns	Defective cable insulation, live metal parts	Adequate electrical protection (correctly ground the unit)

c. Pollution

The unit contains refrigerant gas and lubricating oil. When scrapping the unit these fluids must be recovered and disposed of in compliance with the regulations in force in the country where it is installed. The unit must not be abandoned during the scrapping stage.

SAFETY AND POLLUTION

General recommendations about the R410A refrigerant used

1 SUPPLIER COMPANY AND PRODUCT IDENTIFICATION

Card No.	FRIG 8
Product	R-410A
Supplier company identification	RIVOIRA SpA

2 COMPOSITION / INFORMATION ON INGREDIENTS

Substance / Preparation	Preparation
Components / Impurities	Contains the following components : Difluoromethane (R32) 50 % in weight Pentafluoroethane (R125) 50 % in weight
EEC No.	Non-applicable for mixtures
Trade-name	/ /

3 IDENTIFICATION OF HAZARDS

Identification of hazards	Liquefied gas. The vapours are heavier than air and can cause suffocation, reducing the oxygen available for breathing. Rapid evaporation of the fluid can cause freezing. Can cause cardiac arrhythmia.

4 FIRST-AID MEASURES

Inhalation	Do not administer anything if the person has fainted. Take the person outdoors. Use oxygen or artificial respiration if necessary. Do not administer adrenaline or similar substances.
Contact with eyes	Rinse thoroughly with plenty of water for at least 15 minutes and see a doctor.
Contact with skin	Wash immediately with plenty of water. Immediately remove all contaminated garments.
Swallowing	

5 FIRE-PREVENTION MEASURES

Specific hazards	Increase in pressure.
Dangerous fumes	Halogen acids, traces of carbonyl halides.
Fire-extinguishing means usable	All the known fire-extinguishing means can be used.
Specific methods	Cool the containers/tanks with water sprays.
Special protection equipment	Use self-contained breathing apparatus in confined spaces.

6 MEASURES AGAINST ACCIDENTAL SPILLING OF THE PRODUCT

Personal protection	Evacuate personnel to safe areas. Provide for adequate ventilation. Use personal protection equipment
Protection for the environment	It evaporates.
Product removal methods	It evaporates.

7 HANDLING AND STORAGE

Handling and storage	Ensure an adequate air change and/or extraction in the workplaces. Only use well-ventilated rooms. Do not breathe vapours or aerosols. Carefully close the containers and keep them in a cool, dry and well-ventilated place. Keep in the original containers.
Incompatible products	Explosives, flammable materials, organic peroxides.

8 CONTROL OF EXPOSURE / PERSONAL PROTECTION

Personal protection	Ensure adequate ventilation, especially in closed areas.
Control parameters	Difluoromethane (R32): Recommended exposure limits: AEL (8h and 12h TWA) = 1000 ml/m3 Pentafluoroethane (R125): Recommended exposure limits: AEL (8h and 12h TWA) = 1000 ml/m3
Respiratory tract protection	For rescue and for maintenance works in tanks, use self-contained breathing apparatus. The vapours are heavier than air and can cause suffocation, reducing the oxygen available for breathing.
Eye protection	Total protection glasses.
Hand protection	Rubber gloves.
Hygiene measures	Do not smoke.

9 CHEMICAL-PHYSICAL PROPERTIES

Relative density, gas (air=1)	Heavier than air.
Solubility in water (mg/l)	Not known, but deemed very low.
Appearance	Colourless liquefied gas.
Odour	Similar to ether.
Fire point	Does not ignite.

10 STABILITY AND REACTIVITY

Stability and reactivity	No decomposition if used according to the special instructions.
Materials to be avoided	Alkali metals, alkali-earth metals, granulated metal salts, Al, Zn, Be, etc. in powder.
Hazardous products of decomposition	Halogen acids, traces of carbonyl halides.

11 TOXICOLOGICAL INFORMATION

Local effects	Concentrations substantially above the value TLV (1000 ppm) can cause narcotic effects. Inhalation of highly concentrated products of decomposition can cause respiratory insufficiency (pulmonary oedema).
Long-term toxicity	No carcinogenic, teratogenic or mutagenic effects have been recorded in experiments on animals.
Specific effects	Rapid evaporation of the fluid can cause freezing. Can cause cardiac arrhythmia.

12 ECOLOGICAL INFORMATION

Effects linked to ecotoxicity	Pentafluoroethane (R125) Potential global warming with halocarbides; HGWP (R-11 = 1) = 0.84 Potential impoverishment of the ozone; ODP (R-11 = 1) = 0

13 CONSIDERATIONS ON DISPOSAL

General	Do not dispose of where accumulation can be hazardous. Usable with reconditioning. The depressurised containers must be returned to the supplier. Contact the supplier if instructions for use are deemed necessary.

14 INFORMATION FOR TRANSPORT

Designation for transport	LIQUEFIED GAS N.A.S. (DIFLUOROMETHANE, PENTAFLUOROETHANE)
UN No.	3163
Class/Div	2.2
ADR /RID No.	2, 2nd A
ADR/RID hazard no.	20
ADR label	Label 2 : non-toxic non-flammable gas.
CEFIC Groupcard	20g39 - A
Other information for transport	Avoid transport on vehicles where the loading zone is not separate from the cab. Make sure the driver is informed about the potential risk of the load and knows what to do in case of accident or emergency. Before starting transport, make sure the load is properly secured and : make sure the valve of the container is closed and does not leak; make sure the blind cap of the valve (when provided) is correctly fitted; make sure the cap (when provided) is correctly fitted and that there is an adequate ventilation passage; ensure compliance with the current provisions.

15 INFORMATION ON REGULATIONS

The product must not be labelled according to Directive 1999/45/EC.
Comply with the regulations given below, and the relevant applicable updates and amendments.
Circulars no. 46/79 and 61/81 of the Ministry of Labour : Risks related to the use of products containing aromatic amines
Leg. Decree no. 133/92 : Regulations on the discharge of hazardous substances in waters
Leg. Decree no. 277/91 : Protection of workers against noise, lead and asbestos
Law 256/74, Decree 28/1/92, Leg. Decree no. 52 dated 3/2/97, Decree dated 28/4/97 as amended : Classification, packing and labelling of hazardous substances and preparations
Decree no. 175/88, as amended : Activities with significant accident risks (Seveso Law)
Decree no. 203/88 : Emissions into the atmosphere
Decree no. 303/56 : Work hygiene
Decree no. 547/55 : Regulations on accident prevention
Leg. Decree no.152 dated 11/5/99 : Protection of waters

16 OTHER INFORMATION

Recommended uses	Refrigerant

Can cause suffocation in high concentration.
Keep in a well-ventilated place.
Do not breathe the gas.
The risk of suffocation is often underestimated and must be clearly explained during the training of operators.
Ensure compliance with all the national and regional regulations.
Before using this product in any new process or trial, an in-depth study on safety and compatibility of the product with the materials must be carried out.
The above information is based on our current know-how and describes the product according to the safety requirements. It does not however represent a guarantee and assurance of the qualities in a legal sense. Each person responds personally for compliance with such regulations.

First aid

• Move the victim away from the toxic source, keep him warm and allow him to rest.
• Administer oxygen if necessary.
• Proceed with artificial respiration if necessary.
• Give heart massage in the case of heart failure.
• Immediately seek medical help.

Contact with the skin:
• Immediately thaw the affected parts under running lukewarm water.
• Remove contaminated clothing (garments may stick to the skin in the case of ice burns) if they have not adhered to the skin.
• Seek medical assistance if necessary.

Contact with the eyes:
• Immediately rinse the eyes with physiologic eyewash or clean water for at least 10 minutes with the eyelids pulled open.
• Seek medical assistance if necessary.

Swallowing:
• Do not make the victim vomit. If the victim is conscious, have him rinse his mouth out with clean water and then drink 200, 300 ml of water.
• Immediately seek medical help.
• Do not administer adrenaline or sympathomimetic drugs after exposure owing to the risk of cardiac arrhythmia.
For further information about the characteristics of the refrigerant, consult the technical briefs that can be obtained from manufacturers of refrigerant products.

NOTE

NOTE

Ferroli

COD. 3QE29550

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